

NOTICES

19

	RECOMMENDED FEA BURN	BY SUPPLIER PCT	BARRELS	TOTAL (BARRELS)
UNKNOWN -----				
PUERTO RICO WATER RESOUR	1,776,568			1,776,568
COMMONWEALTH OIL		50.00	888,284	
PUERTO RICO SUN OIL		30.00	532,970	
CARIBBEAN GULF REF		20.00	355,313	
UNKNOWN -----				
ST CROIX, V.I. WTR PWR	38,633			38,633
AMERADA HESS CORP		100.00	38,633	
UNKNOWN -----				
ST THOMAS, V.I. WTR PWR	45,328			45,328
AMERADA HESS CORP		100.00	45,328	

[FR Doc.75-26460 Filed 9-30-75;11:23 am]

federal register

MONDAY, OCTOBER 6, 1975



PART V:

ENVIRONMENTAL PROTECTION AGENCY



REQUIREMENTS FOR SUBMITTAL OF IMPLEMENTATION PLANS

STANDARDS FOR NEW STATIONARY SOURCES

Emission Monitoring

Title 40—Protection of Environment
 CHAPTER I—ENVIRONMENTAL
 PROTECTION AGENCY
 SUBCHAPTER C—AIR PROGRAMS
 [FRL 423-6]

PART 51—REQUIREMENTS FOR THE
 PREPARATION, ADOPTION AND SUB-
 MITTAL OF IMPLEMENTATION PLANS

Emission Monitoring of Stationary Sources

On September 11, 1974, the Environmental Protection Agency (EPA) proposed revisions to 40 CFR Part 51, Requirements for the Preparation, Adoption, and Submittal of Implementation Plans. EPA proposed to expand § 51.19 to require States to revise their State Implementation Plans (SIP's) to include legally enforceable procedures requiring certain specified categories of existing stationary sources to monitor emissions on a continuous basis. Revised SIP's submitted by States in response to the proposed revisions to 40 CFR 51.19 would have (1) required owners or operators of specified categories of stationary sources to install emission monitoring equipment within one year of plan approval, (2) specified the categories of sources subject to the requirements, (3) identified for each category of sources the pollutant(s) which must be monitored, (4) set forth performance specifications for continuous emission monitoring instruments, (5) required that such instruments meet performance specifications through on-site testing by the owner or operator, and (6) required that data derived from such monitoring be summarized and made available to the State on a quarterly basis.

As a minimum, EPA proposed that States must adopt and implement legally enforceable procedures to require monitoring of emissions for existing sources in the following source categories (but only for sources required to limit emissions to comply with an adopted regulation of the State Implementation Plan):

- (a) Coal-fired steam generators of more than 250 million BTU per hour heat input (opacity, sulfur dioxide, oxides of nitrogen and oxygen);
- (b) Oil-fired steam generators of more than 250 million BTU per hour heat input (sulfur dioxide, oxides of nitrogen and oxygen). An opacity monitor was required only if an emission control device is needed to meet particulate emission regulations, or if violations of visible emission regulations are noted;
- (c) Nitric acid plants (oxides of nitrogen);
- (d) Sulfuric acid plants (sulfur dioxide); and
- (e) Petroleum refineries' fluid catalytic cracking unit catalyst regenerators (opacity).

Simultaneously, the Agency proposed similar continuous emission monitoring requirements for new sources for each of the previously identified source categories, subject to the provisions of federal New Source Performance Standards set forth in 40 CFR Part 60. Since many of the technical aspects of the two proposals were similar, if not the same, the pro-

posed regulations for Part 51 (i.e., those relating to SIP's and existing sources) included by reference many specific technical details set forth in 40 CFR Part 60, (39 FR 32852).

At the time of the proposal of the continuous emission monitoring regulations in the FEDERAL REGISTER, the Agency invited comments on the proposed rule-making action. Many interested parties submitted comments. Of the 76 comments received, 35 were from electric utility companies, 26 were from oil refineries or other industrial companies, 12 were from governmental agencies, and 3 were from manufacturers and/or suppliers of emission monitors. No comments were received from environmental groups. Further, prior to the proposal of the regulations in the FEDERAL REGISTER, the Agency sought comments from various State and local air pollution control agencies and instrument manufacturers. Copies of each of these comments are available for public inspection at the EPA Freedom of Information Center, 401 M Street, S.W., Washington, D.C. 20460. These comments have been considered, additional information collected and assessed, and where determined by the Administrator to be appropriate, revisions and amendments have been made in formulating these regulations promulgated herein.

General Discussion of Comments. In general, the comments received by the Agency tended to raise various objections with specific portions of the regulations. Some misinterpreted the proposed regulations, not realizing that emission monitoring under the proposal was not required unless a source was required to comply with an adopted emission limitation or sulfur in fuel limitation that was part of an approved or promulgated State Implementation Plan. Many questioned the Agency's authority and the need to require sources to use continuous emission monitors. Others stated that the proposed regulations were inflationary, and by themselves could not reduce emissions to the atmosphere nor could they improve air quality. A relatively common comment was that the benefits to be derived from the proposed emission monitoring program were not commensurate with the costs associated with the purchase, installation, and operation of such monitors. Many stated that the proposed regulations were not cost-effectively applied and they objected to all sources within an identified source category being required to monitor emissions, without regard for other considerations. For instance, some suggested that it was unnecessary to monitor emissions from steam generating plants that may soon be retired from operation, or steam generating boilers that are infrequently used (such as for peaking and cycling operations) or for those sources located in areas of the nation which presently have ambient concentrations better than national ambient air quality standards. This latter comment was especially prevalent in relation to the need for continuous emission monitors designed to measure emissions of oxides of nitrogen. Further, commentators generally suggested that

state and local control agencies, rather than EPA should be responsible for determining which sources should monitor emissions. In this regard, the commentators suggested that a determination of the sources which should install continuous monitors should be made on a case-by-case basis. Almost all objected to the data reporting requirements stating that the proposed requirement of submission of all collected data was excessive and burdensome. Comments from state and local air pollution control agencies in general were similar to those from the utility and industrial groups, but in addition, some indicated that the manpower needed to implement the programs required by the proposed regulations was not available.

Rationale for Emission Monitoring Regulation. Presently, the Agency's regulations setting forth the requirements for approvable SIP's require States to have legal authority to require owners or operators of stationary sources to install, maintain, and use emission monitoring devices and to make periodic reports of emission data to the State (40 CFR 51.11(a)(6)). This requirement was designed to partially implement the requirements of Sections 110(a)(2)(F)(ii) and (iii) of the Clean Air Act, which state that implementation plans must provide "requirements for installation of equipment by owners or operators of stationary sources to monitor emissions from such sources", and "for periodic reports on the nature and amounts of such emissions". However, the original implementation plan requirements did not require SIP's to contain legally enforceable procedures mandating continuous emission monitoring and recording. At the time the original requirements were published, the Agency had accumulated little data on the availability and reliability of continuous monitoring devices. The Agency believed that the state-of-the-art was such that it was not prudent to require existing sources to install such devices.

Since that time, much work has been done by the Agency and others to field test and compare various continuous emission monitors. As a result of this work, the Agency now believes that for certain sources, performance specifications for accuracy, reliability and durability can be established for continuous emission monitors of oxygen, carbon dioxide, sulfur dioxide, and oxides of nitrogen and for the continuous measurement of opacity. Accordingly, it is the Administrator's judgment that Sections 110(a)(2)(F)(ii) and (iii) should now be more fully implemented.

The Administrator believes that a sound program of continuous emission monitoring and reporting will play an important role in the effort to attain and maintain national standards. At the present time, control agencies rely upon infrequent manual source tests and periodic field inspections to provide much of the enforcement information necessary to ascertain compliance of sources with adopted regulations. Manual source tests are generally performed on a relatively infrequent basis, such as

once per year, and in some cases, affected sources probably have never been tested. Manual stack tests are generally performed under optimum operating conditions, and as such, do not reflect the full-time emission conditions from a source. Emissions continually vary with fuel firing rates, process material feed rates and various other operating conditions. Since manual stack tests are only conducted for a relatively short period of time (e.g., one to three hours), they cannot be representative of all operating conditions. Further, frequent manual stack tests (such as conducted on a quarterly or more frequent basis) are costly and may be more expensive than continuous monitors that provide much more information. State Agency enforcement by field inspection is also sporadic, with only occasional inspection of certain sources, mainly for visible emission enforcement.

Continuous emission monitoring and recording systems, on the other hand, can provide a continuous record of emissions under all operating conditions. The continuous emission monitor is a good indicator of whether a source is using good operating and maintenance practices to minimize emissions to the atmosphere and can also provide a valuable record to indicate the performance of a source in complying with applicable emission control regulations. Additionally, under certain instances, the data from continuous monitors may be sufficient evidence to issue a notice of violation. The continuous emission record can also be utilized to signal a plant upset or equipment malfunction so that the plant operator can take corrective action to reduce emissions. Use of emission monitors can therefore provide valuable information to minimize emissions to the atmosphere and to assure that full-time control efforts, such as good maintenance and operating conditions, are being utilized by source operators.

The Agency believes that it is necessary to establish national minimum requirements for emission monitors for specified sources rather than allow States to determine on a case-by-case basis the specific sources which need to continuously monitor emissions. The categories specified in the regulations represent very significant sources of emissions to the atmosphere. States in developing SIPs have generally adopted control regulations to minimize emissions from these sources. Where such regulations exist, the Agency believes that continuous emission monitors are necessary to provide information that may be used to provide an indication of source compliance. Further, it is believed that if the selection of sources on a case-by-case basis were left to the States, that some States would probably not undertake an adequate emission monitoring program. Some State Agencies who commented on the proposed regulations questioned the state-of-the-art of emission monitoring and stated their opinion that the proposed requirements were premature. Therefore, it is the Administrator's judgment that, in order to assure an

adequate nationwide emission monitoring program, minimum emission monitoring requirements must be established.

The source categories affected by the regulations were selected because they are significant sources of emissions and because the Agency's work at the time of the proposal of these regulations in the field of continuous emission monitoring evaluation focused almost exclusively on these source categories. The Agency is continuing to develop data on monitoring devices for additional source categories. It is EPA's intent to expand the minimum continuous emission monitoring requirements from time to time when the economic and technological feasibility of continuous monitoring equipment is demonstrated and where such monitoring is deemed appropriate for other significant source categories.

Discussion of Major Comments. Many commenters discussed the various cost aspects of the proposed regulations, specifically stating that the costs of continuous monitors were excessive and inflationary. A total of 47 commenters expressed concern for the cost and/or cost effectiveness of continuous monitors. Further, the Agency's cost estimates for purchasing and installing monitoring systems and the costs for data reduction and reporting were questioned. In many cases, sources provided cost estimates for installation and operation of continuous monitors considerably in excess of the cost estimates provided by the Agency.

In response to these comments, a further review was undertaken by the Agency to assess the cost impact of the regulations. Three conclusions resulted from this review. First, it was determined that the cost ranges of the various emission monitoring systems provided by the Agency are generally accurate for new sources. Discussions with equipment manufacturers and suppliers confirmed this cost information. Approximate investment costs, which include the cost of the emission monitor, installation cost at a new facility, recorder, performance testing, data reporting systems and associated engineering costs are as follows: for opacity, \$20,000; for sulfur dioxide and oxygen or oxides of nitrogen and oxygen, \$30,000; and for a source that monitors opacity, oxides of nitrogen, sulfur dioxide and oxygen, \$55,000. Annual operating costs, which include data reduction and report preparation, system operation, maintenance, utilities, taxes, insurance and annualized capital costs at 10% for 8 years are: \$8,500; \$16,000; and \$30,000 respectively for the cases described above.⁽¹⁾

Secondly, the cost review indicated that the cost of installation of emission monitors for existing sources could be considerably higher than for new sources because of the difficulties in providing access to a sampling location that can provide a representative sample of emissions. The cost estimates provided by the Agency in the proposal were specifically developed for new sources whose installation costs are relatively stable since provisions for monitoring equipment can be incorporated at the time of plant design. This feature is not available for ex-

isting sources, hence higher costs generally result. Actual costs of installation at existing sources may vary from one to five times the cost of normal installation at new sources, and in some cases even higher costs can result. For example, discussions with instrument suppliers indicate that a typical cost of installation of an opacity monitor on an existing source may be two to three times the purchase price of the monitor. Difficulties also exist for installation of gaseous monitors at existing sources.

It should be noted that these installation costs include material costs for scaffolding, ladders, sampling ports and other items necessary to provide access to a location where source emissions can be measured. It is the Agency's opinion that such costs cannot be solely attributed to these continuous emission monitoring regulations. Access to sampling locations is generally necessary to determine compliance with applicable state or local emission limitations by routine manual stack testing methods. Therefore, costs of providing access to a representative sampling location are more directly attributed to the cost of compliance with adopted emission limitations, than with these continuous emission monitoring regulations.

Lastly, the review of cost information indicated that a number of commenters misinterpreted the extent of the proposed regulations, thereby providing cost estimates for continuous monitors which were not required. Specifically, all commenters did not recognize that the proposed regulations required emission monitoring for a source only if an applicable State or local emission limitation of an approved SIP affected such a source. For example, if the approved SIP did not contain an adopted control regulation to limit oxides of nitrogen from steam-generating, fossil fuel-fired boilers of a capacity in excess of 250 million BTU per hour heat input, then such source need not monitor oxides of nitrogen emissions. Further, some utility industry commenters included the costs of continuous emission monitors for sulfur dioxide. The proposed regulations, however, generally allowed the use of fuel analysis by specified ASTM procedures as an alternative which, in most cases, is less expensive than continuous monitoring. Finally, the proposed regulations required the continuous monitoring of oxygen in the exhaust gas only if the source must otherwise continuously monitor oxides of nitrogen or sulfur dioxide. Oxygen information is used solely to provide a correction for excess air when converting the measurements of gaseous pollutants concentrations in the exhaust gas stream to units of an applicable emission limitation. Some commenters did not recognize this point (which was not specifically stated in the proposed regulations) and provided cost estimates for oxygen monitors when they were not required by the proposed regulations.

While not all commenters' cost estimates were correct, for various reasons noted above, it is clear that the costs associated with implementing these emission monitoring regulations are sig-

nificant. The Administrator, however, believes that the benefits to be derived from emission monitoring are such that the costs are not unreasonable. The Administrator does, however, agree with many commentators that the proposed regulations, in some cases, were not applied cost-effectively and, as such, the regulations promulgated herein have been modified to provide exemptions to certain sources from these minimum requirements.

One comment from another Federal Agency concerned the time period that emissions are to be averaged when reporting excess emissions. Specifically, the commentator assumed that the emission control regulations that have been adopted by State and local agencies were generally designed to attain annual ambient air quality standards. As such, the commentator pointed out that short-term emission levels in excess of the adopted emission standard should be acceptable for reasonable periods of time.

The Administrator does not agree with this rationale for the following reasons. First, it is not universally true that annual ambient standards were the design basis of emission control regulations. In many cases, reductions to attain short-term standards require more control than do annual standards. Even if the regulations were based upon annual standards, allowing excess emissions of the adopted emission control regulation on a short-term basis could cause non-compliance with annual standards. More importantly, however, a policy of legally allowing excesses of adopted control regulations would in effect make the current emission limitation unenforceable. If the suggestion were implemented, a question would arise as to what is the maximum emission level that would not be considered an excess to the adopted regulation. The purpose of the adopted emission limitation was to establish the acceptable emission level. Allowing emissions in excess of that adopted level would cause confusion, ambiguity, and in many cases could result in an unenforceable situation. Hence the Administrator does not concur with the commentator's suggestion.

Modifications to the Proposed Regulations. The modification to the regulations which has the most significant impact involves the monitoring requirements for oxides of nitrogen at fossil fuel-fired steam generating boilers and at nitric acid plants. Many commentators correctly noted that the Agency in the past (June 8, 1973, 38 FR 15174) had indicated that the need for many emission control regulations for oxides of nitrogen were based upon erroneous data. Such a statement was made after a detailed laboratory analysis of the reference ambient measurement method for nitrogen dioxide revealed the method to give false measurements. The sampling technique generally indicated concentrations of nitrogen dioxide higher than actually existed in the atmosphere. Since many control agencies prior to that announcement had adopted emission regulations that were determined to be needed based upon

these erroneous data, and since new data, collected by other measurement techniques, indicated that in most areas of the nation such control regulations were not necessary to satisfy the requirements of the SIP, the Agency suggested that States consider the withdrawal of adopted control regulations for the control of oxides of nitrogen from their SIP's (May 8, 1974, 39 FR 16344). In many States, control agencies have not taken action to remove these regulations from the SIP. Hence, the commentators pointed out that the proposed regulations to require continuous emission monitors on sources affected by such regulations is generally unnecessary.

Because of the unique situation involving oxides of nitrogen control regulations, the Administrator has determined that the proposed regulations to continuously monitor oxides of nitrogen emissions may place an undue burden on source operators, at least from a standpoint of EPA specifying minimum monitoring requirements. The continuous emission monitoring requirements for such sources therefore have been modified. The final regulations require the continuous emission monitoring of oxides of nitrogen only for those sources in Air Quality Control Regions (AQCR's) where the Administrator has specifically determined that a control strategy for nitrogen dioxide is necessary. At the present time such control strategies are required only for the Metropolitan Los Angeles Intra-state and the Metropolitan Chicago Interstate AQCR's.

It should be noted that a recent compilation of valid nitrogen dioxide air quality data suggests that approximately 14 of the other 245 AQCR's in the nation may need to develop a control strategy for nitrogen dioxide. These AQCR's are presently being evaluated by the Agency. If any additional AQCR's are identified as needing a control strategy for nitrogen dioxide at that time, or any time subsequent to this promulgation, then States in which those AQCR's are located must also revise their SIP's to require continuous emission monitoring for oxides of nitrogen for specified sources. Further, it should be noted that the regulations promulgated today are minimum requirements, so that States, if they believe the control of oxides of nitrogen from sources is necessary may, as they deem appropriate, expand the continuous emission monitoring requirements to apply to additional sources not affected by these minimum requirements.

Other modifications to the proposed regulation resulted from various comments. A number of commentators noted that the proposed regulations included some sources whose emission impact on air quality was relatively minor. Specifically, they noted that fossil fuel-fired steam generating units that were used solely for peaking and cycling purposes should be exempt from the proposed regulations. Similarly, some suggested that smaller sized units, particularly steam-generating units less than 2,500 million BTU per hour heat input, should also be exempted. Others pointed out that

units soon to be retired from operation should not be required to install continuous monitoring devices and that sources located in areas of the nation that already have air quality better than the national standards should be relieved of the required monitoring and reporting requirements. The Agency has considered these comments and has made the following judgments.

In relation to fossil fuel-fired steam generating units, the Agency has determined that such units that have an annual boiler capacity factor of 30% or less as currently defined by the Federal Power Commission shall be exempt from the minimum requirements for monitoring and reporting. Industrial boilers used at less than 30% of their annual capacity, upon demonstration to the State, may also be granted an exemption from these monitoring requirements. The rationale for this exemption is based upon the fact that all generating units do not produce power at their full capacity at all times. There are three major classifications of power plants based on the degree to which their rated capacity is utilized on an annual basis. Baseload units are designed to run at near full capacity almost continuously. Peaking units are operated to supply electricity during periods of maximum system demand. Units which are operated for intermediate service between the extremes of baseload and peaking are termed cycling units.

Generally accepted definitions term units generating 60 percent or more of their annual capacity as baseload, those generating less than 20 percent as peaking and those between 20 and 60 percent as cycling. In general, peaking units are older, smaller, of lower efficiency, and more costly to operate than base load or cycling units. Cycling units are also generally older, smaller and less efficient than base load units. Since the expected life of peaking units is relatively short and total emissions from such units are small, the benefits gained by installing monitoring instruments are small in comparison to the cost of such equipment. For cycling units, the question of cost-effectiveness is more difficult to ascertain. The units at the upper end of the capacity factor range (i.e., near 60% boiler capacity factor) are candidates for continuous emission monitoring while units at the lower end of the range (i.e., near 20% boiler capacity factor) do not represent good choices for continuous monitors. Based upon available emission information, it has been calculated that fossil fuel-fired steam generating plants with a 30% or less annual boiler capacity factor contribute approximately less than 5% of the total sulfur dioxide from all such power plants. (2) Hence, the final regulations do not affect any boiler that has an annual boiler capacity factor of less than 30%. Monitoring requirements will thus be more cost effectively applied to the newer, larger, and more efficient units that burn a relatively larger portion of the total fuel supply.

Some commentators noted that the age of the facility should be considered in relation to whether a source need com-

ply with the proposed regulations. For fossil fuel-fired steam generating units, the exemption relating to the annual boiler capacity factor previously discussed should generally provide relief for older units. It is appropriate, however, that the age of the facility be considered for other categories of sources affected by the proposed regulations. As such, the final regulations allow that any source that is scheduled to be retired within five years of the inclusion of monitoring requirements for the source in Appendix P need not comply with the minimum emission monitoring requirements promulgated herein. In the Administrator's judgment, the selection of five years as the allowable period for this exemption provides reasonable relief for those units that will shortly be retired. However, it maintains full requirements on many older units with a number of years of service remaining. In general, older units operate less efficiently and are less well controlled than newer units so that emission monitoring is generally useful. The exemption provided in the final regulations effectively allows such retirees slightly more than a two-year period of relief, since the schedule of implementation of the regulations would generally require the installation of emission monitors by early 1978. States must submit, for EPA approval, the procedures they will implement to use this provision. States are advised that such exemptions should only be provided where a bona fide intent to cease operations has been clearly established. In cases where such sources postpone retirement, States shall have established procedures to require such sources to monitor and report emissions. In this regard, it should be noted that Section 113(c) (2) of the Act provides that any person who falsifies or misrepresents a record, report or other document filed or required under the Act shall, upon conviction, be subject to fine or imprisonment, or both.

A further modification to the proposed regulations affects the minimum size of the units within each of the source categories to which emission monitoring and reporting shall be required. As suggested by many commentors, the Agency has investigated the cost effectiveness of requiring all units within the identified source categories to install emission monitors. Each pollutant for each source category identified in the proposed regulations was evaluated. For fossil fuel-fired steam generating units, the proposal required compliance for all boilers with 250 million BTU per hour heat input, or greater. For opacity, the proposed regulations required emission monitoring for all coal-fired units, while only those oil-fired units that had been observed as violators of visible emission regulations or must use an emission control device to meet particulate matter regulations were required to install such devices. Gas-fired units were exempted by the proposed regulations.

After investigating the particulate emission potential of these sources, it has been determined that no modification in

the size limitation for boilers in relation to opacity is warranted. The rationale for this judgment is that the smaller-sized units affected by the proposed regulation tend to be less efficiently operated or controlled for particulate matter than are the larger-sized units. In fact, smaller units generally tend to emit more particulate emissions on an equivalent fuel basis than larger-sized units. (2) Because of the potential of opacity regulation violations, no modifications have been made to the regulations as to the size of steam generating boilers that must measure opacity.

Emissions of oxides of nitrogen from boilers are a function of the temperature in the combustion chamber and the cooling of the combustion products. Emissions vary considerably with the size and the type of unit. In general, the larger units produce more oxides of nitrogen emissions. The Agency therefore finds that the minimum size of a unit affected by the final regulations can be increased from 250 to 1,000 million BTU per hour heat input, without significantly reducing the total emissions of oxides of nitrogen that would be affected by monitoring and reporting requirements. Such a modification would have the effect of exempting approximately 56% of the boilers over 250 million BTU per hour heat input capacity, on a national basis, while maintaining emission monitoring and reporting requirements for approximately 78% of the potential oxides of nitrogen emissions from such sources. (2) Further, in the 2 AQCR's where the Administrator has specifically called for a control strategy for nitrogen dioxide, the boilers affected by the regulation constitute 50% of the steam generators greater than 250 million BTU per hour heat input, yet they emit 80% of the nitrogen oxides from such steam generators in these 2 AQCR's. (2)

Also, certain types of boilers or burners, due to their design characteristics, may on a regular basis attain emission levels of oxides of nitrogen well below the emission limitations of the applicable plan. The regulations have been revised to allow exemption from the requirements for installing emission monitoring and recording equipment for oxides of nitrogen when a facility is shown during performance tests to operate with oxides of nitrogen emission levels 30% or more below the emission limitation of the applicable plan. It should be noted that this provision applies solely to oxides of nitrogen emissions rather than other pollutant emissions, since oxides of nitrogen emissions are more directly related to boiler design characteristics than are other pollutants.

Similar evaluations were made for nitric acid plants, sulfuric acid plants and catalytic cracking unit catalyst regenerators at petroleum refineries. For each of these industries it was found that modifications to the proposed regulations could be made to increase the minimum size of the units affected by the proposed regulations without significantly decreasing the total emissions of various

pollutants that would be affected by these monitoring and reporting requirements. Specifically, for nitric acid plants it was found that by modifying the proposed regulations to affect only those plants that have a total daily production capacity of 300 tons or more of nitric acid (rather than affecting all facilities as proposed) that approximately 79% of the nitric acid production on a national basis would be affected by the provisions of these monitoring and reporting requirements. On the other hand, such a modification reduces the number of monitors required for compliance with these regulations by approximately 46%. (2) At the present time, only nitric acid plants in AQCR's where the Administrator has specifically called for a control strategy for nitrogen dioxide will be candidates for continuous emission monitoring requirements for the reasons mentioned previously. In the 2 AQCR's where such a control strategy has been called for, there is only one known nitric acid plant and that is reported to be less than 300 tons per day production capacity—hence no nitric acid plants at the present time will be affected by these monitoring requirements.

Similarly, evaluations of sulfuric acid plants and catalytic cracking catalyst regenerators at petroleum refineries resulted in the conclusion that minimum size limitations of 300 tons per day production rate at sulfuric acid plants, and 20,000 barrels per day of fresh feed to any catalytic cracking unit at petroleum refineries could be reasonably established. Such modifications exempt approximately 37% and 39% respectively of such plants on a national basis from these emission monitoring and reporting requirements, while allowing about 9% of the sulfur dioxide emissions from sulfuric acid plants and 12% of the particulate matter emissions from catalytic cracking units to be emitted to the atmosphere without being measured and reported. (2) The Agency believes that such modifications provide a reasonable balance between the costs associated with emission monitoring and reporting, and the need to obtain such information.

A number of commentors suggested that sources be exempt from the proposed emission monitoring regulations if such sources are located within areas of the nation that are already attaining national standards. The Administrator does not believe that such an approach would be consistent with Section 110 of the Clean Air Act, which requires continued maintenance of ambient standards after attainment. In many areas, the standards are being attained only through effective implementation of emission limitations. Under the Clean Air Act, continued compliance with emission limitations in these areas is just as important as compliance in areas which have not attained the standards.

Another major comment concerned the proposed data reporting requirements. Thirty-four (34) commentors expressed concern at the amount of data which the proposed regulations required to be recorded, summarized, and submit-

ted to the State. It was generally indicated by the commentors that the data reporting requirements were excessive. Commentors questioned the purpose of reporting all measured data while some State agencies indicated they have limited resources to handle such information. EPA believes that, in some cases, the commentors misconstrued the data reporting requirements for existing sources. In light of each of these comments, the final regulations, with respect to the data reporting requirements for gaseous pollutants and opacity, have been modified.

For gaseous emissions, the proposed regulations required the reporting of all one-hour averages obtained by the emission monitor. Because of the comments on this provision, the Agency has reexamined the proposed data reporting requirements. As a result, the Agency has determined that only information concerning emissions in excess of emission limitations of the applicable plan is necessary to satisfy the intent of these regulations. Therefore, the data reporting requirements for gaseous pollutants have been modified. The final regulations require that States adopt procedures that would require sources to report to the State on emission levels in excess of the applicable emission limitations (i.e., excess emissions) for the time period specified in the regulation with which compliance is determined. In other words, if an applicable emission limitation required no more than 1.0 pounds per hour SO₂ to be emitted for any two-hour averaging period, the data to be reported by the source should identify the emission level (i.e., emissions stated in pounds per hour) averaged over a two-hour time period, for periods only when this emission level was in excess of the 1.0 pounds per hour emission limitation. Further, sources shall be required to maintain a record of all continuous monitoring observations for gaseous pollutants (and opacity measurements) for a period of two years and to make such data available to the State upon request. The final regulations have also been amended to add a provision to require sources to report to the State on the apparent reason for all noted violations of applicable regulations.

The proposed data reporting requirements for opacity have also been modified. Upon reconsideration of the extent of the data needed to satisfy the intent of these regulations, it is the Administrator's judgment that for opacity States must obtain excess emission measurements during each hour of operation. However, before determining excess emissions, the number of minutes generally exempted by State opacity regulations should be considered. For example, where a regulation allows two minutes of opacity measurements in excess of the standard, the State need only require the source to report all opacity measurements in excess of the standard during any one hour, minus the two-minute exemption. The excess measurements shall be reported in actual per cent opacity averaged for

one clock minute or such other time period deemed appropriate by the State. Averages may be calculated either by arithmetically averaging a minimum of 4 equally spaced data points per minute or by integration of the monitor output.

Some commentors raised questions concerning the provisions in the proposed regulations which allow the use of fuel analysis for computing emissions of sulfur dioxide in lieu of installing a continuous monitoring device for this pollutant. Of primary concern with the fuel analysis approach among the commentors was the frequency of the analysis to determine the sulfur content of the fuel. However, upon inspection of the comments by the Agency, a more significant issue has been uncovered. The issue involves the determination of what constitutes excess emissions when a fuel analysis is used as the method to measure source emissions. For example, the sulfur content varies significantly within a load of coal, i.e., while the average sulfur content of a total load of coal may be within acceptable limits in relation to a control regulation which restricts the sulfur content of coal, it is probable that portions of the coal may have a sulfur content above the allowable level. Similarly, when fuel oils of different specific gravities are stored within a common tank, such fuel oils tend to stratify and may not be a homogeneous mixture. Thus, at times, fuel oil in excess of allowable limits may be combusted. The question which arises is whether the combustion of this higher sulfur coal or oil is a violation of an applicable sulfur content regulation. Initial investigations of this issue have indicated a relative lack of specificity on the subject.

The Agency is confronted with this problem not only in relation to specifying procedures for the emission reporting requirements for existing sources but also in relation to enforcement considerations for new sources affected by New Source Performance Standards. At this time, a more thorough investigation of the situation in necessary prior to promulgation of procedures dealing with fuel analysis for both oil and coal. At the conclusion of this investigation, the Agency will set forth its findings and provide guidance to State and local control agencies on this issue. In the meantime, the portion of the proposed regulations dealing with fuel analysis is being withheld from promulgation at this time. As such, States shall not be required to adopt provisions dealing with emission monitoring or reporting of sulfur dioxide emissions from those sources where the States may choose to allow the option of fuel analysis as an alternative to sulfur-dioxide monitoring. However, since the fuel analysis alternative may not be utilized by a source that has installed sulfur dioxide control equipment (scrubbers), States shall set forth legally enforceable procedures which require emission monitors on such sources, where these emission monitoring regulations otherwise require their installation.

Other Modifications to Proposed Regulations. In addition to reducing the number of monitors required under the

proposed regulations, a number of modifications to various procedures in the proposed regulations have been considered and are included in the final regulations. One modification which has been made is the deletion of the requirement to install continuous monitors at "the most representative" location. The final regulations require the placement of an emission monitor at "a representative" location in the exhaust gas system. In many cases "the most representative" location may be difficult to locate and may be inaccessible without new platforms, ladders, etc., being installed. Further, other representative locations can provide adequate information on pollutant emissions if minimum criteria for selection of monitoring locations are observed. Guidance in determining a representative sampling location is contained within the Performance Specification for each pollutant monitor in the emission monitoring regulations for New Source Performance Standards (Appendix B, Part 60 of this Chapter). While these criteria are designed for new sources, they are also useful in determining representative locations for existing sources.

A further modification to the proposed regulation is the deletion of the requirement for new performance tests when continuous emission monitoring equipment is modified or repaired. As proposed, the regulation would have required a new performance test whenever any part of the continuous emission monitoring system was replaced. This requirement was originally incorporated in the regulations to assure the use of a well-calibrated, finely tuned monitor. Commentors pointed out that the requirement of conducting new performance tests whenever any part of an instrument is changed or replaced is costly and in many cases not required. Upon evaluation of this comment, the Administrator concurs that performance tests are not required after each repair or replacement to the system. Appropriate changes have been made to the regulations to delete the requirements for new performance tests. However, the final regulations require the reporting of the various repairs made to the emission monitoring system during each quarter to the State. Further, the State must have procedures to require sources to report to the State on a quarterly basis information on the amount of time and the reason why the continuous monitor was not in operation. Also the State must have legally enforceable procedures to require a source to conduct a new performance test whenever, on the basis of available information, the State deems such test is necessary.

The time period proposed for the installation of the required monitoring system, i.e., one year after plan approval, was thought by 21 commentors to be too brief, primarily because of lack of available instruments, the lack of trained personnel and the time available for installation of the required monitors. Equipment suppliers were contacted by the Agency and they confirmed the availability of emission monitors. However,

the Administrator has determined that the time necessary for purchase, installation and performance testing of such monitors may require more than one year for certain installations, especially where gaseous monitors are required. In order to provide sources with ample time, the Agency has modified the final regulations to allow States to adopt procedures that will provide sources 18 months after the approval or promulgation of the revised SIP to satisfy the installation and performance testing procedures required by these continuous monitoring regulations. A provision is also included to allow, on a case-by-case basis, additional extensions for sources where good faith efforts have been undertaken to purchase and install equipment, but where such installation cannot be accomplished within the time period prescribed by the regulations.

A number of State and local agencies also commented on the lack of time provided sources to install the monitors required by the proposed regulations. These agencies also indicated that they must acquire sufficient skilled manpower to implement the regulations, such as personnel to provide guidance to sources, to monitor performance tests and to analyze the emission data that are to be submitted by the sources. Further, some State agencies indicated that more than six months was needed to develop the necessary plan revisions. Most State agencies who commented stated that one year should be provided to allow States to revise their SIP's. The Administrator is aware of the various priorities which confront State and local agencies at this time (e.g., compliance schedules, enforcement actions, litigation proceedings, re-evaluation of adequacy of SIP's to attain and maintain national standards, etc.) and, as such, believes that a six-month postponement in the submittal of plan revisions to require emission monitoring and reporting is justified and prudent. Hence, States must submit plan revisions to satisfy the requirements of this section within one year of promulgation of these regulations in the *FEDERAL REGISTER*. However, States are advised that such plan revisions may be submitted any time prior to the final date, and are encouraged to do so where possible.

The proposed regulations provided the States with the option of allowing sources to continue to use emission monitoring equipment that does not meet performance specifications set forth in the regulations for up to five years from the date of approval of the State regulations or EPA promulgation. Some commenters asked that this provision be extended indefinitely. In some cases they indicated they had recently purchased and had already installed monitoring systems which were only marginally away from meeting the applicable performance specifications. The Agency believes, however, that such a modification to the proposed regulations should not be allowed. It is believed that such a provision would result in inadequate monitoring systems being maintained after their useful life has ended. Though some monitoring sys-

tems will probably last longer than five years, it is believed that this time period will provide adequate time to amortize the cost of such equipment. In cases where existing emission monitors are known not to provide reasonable estimates of emissions, States should consider more stringent procedures to provide a more speedy retirement of such emission monitoring systems.

Some commenters raised the question of whether existing oxygen monitors which are installed in most fossil fuel-fired steam generating boilers to monitor excess oxygen for the purposes of combustion control could be used to satisfy the requirement for monitoring oxygen under the proposal. Upon investigation, it has been determined that, in some cases, such oxygen monitors may be used provided that they are located so that there is no influx of dilution air between the oxygen monitor and the continuous pollutant monitor. In some cases, it may be possible to install the continuous monitoring device at the same location as the existing oxygen monitor. Care should be taken, however, to assure that a representative sample is obtained. Because of the various possibilities that may arise concerning the usefulness of existing oxygen monitors, the State should determine, after a case-by-case review, the acceptability of existing oxygen monitors.

Another technical issue which was raised suggested that continuous emission monitors which provide direct measurements of pollutants in units comparable to the emission limitations and other devices not specifically identified in the proposed regulations are available for purchase and installation. The Agency is aware that various monitoring systems exist but has not as yet determined specific performance specifications for these monitoring systems that are directly applicable to the source categories covered by these regulations. However, it is not EPA's intent to deny the use of any equipment that can be demonstrated to be reliable and accurate. If monitors can be demonstrated to provide the same relative degree of accuracy and durability as provided by the performance specifications in Appendix B of Part 60, they shall generally be acceptable to satisfy the requirements of these regulations under Section 3.9 of Appendix P. Further, where alternative procedures (e.g., alternate procedures for conversion of data to units of applicable regulations) can be shown by the State to be equivalent to the procedures set forth in Appendix P of these regulations, then such alternate procedures may be submitted by the State for approval by EPA. Section 3.9 of Appendix P identifies certain examples where alternative emission monitoring systems or alternative procedures will generally be considered by the Agency for approval.

It should be noted that some sources may be unable to comply with the regulations because of technical difficulties, (e.g., the presence of condensed water vapor in the flue gas), physical limitations of accessibility at the plant facility,

or, in other cases, because of extreme economic hardship. States should use their judgment in implementing these requirements in such cases. Section 6 of Appendix P of this Part provides various examples where the installation of continuous emission monitors would not be feasible or reasonable. In such cases alternate emission monitoring (and reporting) by more routine methods, such as manual stack testing, must be required. States in preparing their revised SIP must set forth and describe the criteria they will use to identify such unusual cases, and must further describe the alternative procedures they will implement to otherwise satisfy the intent of these regulations. States are advised that this provision is intended for unusual cases, and, as such, should not be widely applied.

It was pointed out by some commenters that carbon dioxide monitors could probably be used in lieu of oxygen monitors to provide information to convert emission data to the units of the applicable State regulation. Detailed discussion of the technical merits and limitations of this approach is discussed in the Preamble to the Part 60 Regulations. As pointed out in that Preamble, such monitors may be used in certain situations. Modifications have therefore been made to the Part 51 regulations to allow the use of such monitors which include references to technical specifications contained in Part 60 for carbon dioxide monitors. Also, the cycling time for oxygen monitors has been changed from one hour to 15 minutes to correspond to the specification in Part 60. The difference between cycling times in the two proposals was an oversight. The cycling time for carbon dioxide monitors will also be 15 minutes as in Part 60.

A number of other miscellaneous technical comments were also received. Commenters indicated that the proposed exemption for opacity monitoring requirements that may be granted to oil-fired and gas-fired steam generators should also apply to units burning a combination of these fuels. The Administrator concurs with this suggestion and an exemption for such sources burning oil and gas has been provided in the final regulations subject to the same restrictions as are imposed on oil-fired steam generators.

As previously indicated, the regulations for emission monitoring for existing sources refer in many cases to the specific performance specifications set forth in the emission monitoring regulations for new sources affected by Part 60. Many of the comments received on the proposed regulations in effect pointed to issues affecting both proposals. In many cases, more specific technical issues are discussed in the Preamble to the Part 60 Regulations and as such the reader is referred to that Preamble. Specifically, the Part 60 Preamble addresses the following topics: data handling and reporting techniques; requirements for reporting repairs and replacement parts used; location of monitoring instruments; changes to span requirements, operating

frequency requirements, sulfuric acid and nitric acid plant conversion factors; and, for opacity monitoring equipment, changes in the cycling time and in alignment procedures. The reader is cautioned, however, that specific reference to regulations in the Part 60 Preamble is strictly to federal New Source Performance Regulations rather than State and local control agency regulations which affect existing sources and which are part of an applicable plan.

In addition to the many technical comments received, a number of legal issues were raised. Several commenters questioned EPA's statutory authority to promulgate these regulations and pointed out other alleged legal defects in the proposal. The Administrator has considered these comments, and has found them unpersuasive.

One commentator argued that new 40 CFR 51.19(e) will require "revisions" to existing state plans; that "revisions" may be called for under Section 110(a)(2)(H) of the Clean Air Act only where EPA has found that there are "improved or more expeditious methods" for achieving ambient standards or that a state plan is "substantially inadequate" to achieve the standards; that the new regulation is based upon neither of these findings; and that therefore there is no statutory authority for the regulation. This argument fails to take cognizance of Section 110(a)(2)(F)(ii) of the Act, which mandates that all state implementation plans contain self-monitoring requirements. The fact that EPA originally accepted plans without these requirements because of substantial uncertainty as to the reliability of self-monitoring equipment does not negate the mandate of the statute.

In essence, new § 51.19(e) does not call for "revisions" as contemplated by the Act, but for supplements to the original plans to make them complete. At any rate, it is the Administrator's judgment that the new self-monitoring requirements will result in a "more expeditious" achievement of the ambient standards. Since these requirements are valuable enforcement tools and indicators of malfunctions, they should lead to a net decrease in emissions.

Other commentators argued that even if EPA has statutory authority to require self-monitoring, it has no authority to impose specific minimum requirements for state plans, to require "continuous" monitoring, or to require monitoring of oxygen, which is not a pollutant. These comments fail to consider that a basic precept of administrative law is that an agency may fill in the broad directives of legislation with precise regulatory requirements. More specifically, the Administrator has authority under Section 301(a) of the Clean Air Act to promulgate "such regulations as are necessary to carry out his functions under the Act". Courts have long upheld the authority of agencies to promulgate more specific requirements than are set forth in enabling legislation, so long as the requirements are reasonably related to the purposes of the legislation. Since the Act

requires self-monitoring without further guidance, EPA surely has the authority to set specific requirements in order to carry out its function of assuring that the Act is properly implemented.

In EPA's judgment, the requirements set forth in § 51.19(e) are necessary to assure that each state's self-monitoring program is sufficient to comply with the Act's mandate. The fact that oxygen and carbon dioxide are not air pollutants controlled under the Act is legally irrelevant, since in EPA's judgment, they must be monitored in order to convert measured emission data to units of emission standards.

Other commentators have argued that the self-monitoring requirements violate the protection against self-incrimination provided in the Fifth Amendment to the U.S. Constitution, and that the information obtained from the monitoring is so unreliable as to be invalid evidence for use in court.

There are two reasons why the self-incrimination argument is invalid. First, the self-incrimination privilege does not apply to corporations, and it is probable that a great majority of the sources covered by these requirements will be owned by corporations. Secondly, courts have continually recognized an exception to the privilege for "records required by law", such as the self-monitoring and reporting procedures which are required by the Clean Air Act. As to the validity of evidence issue, in EPA's opinion, the required performance specifications will assure that self-monitoring equipment will be sufficiently reliable to withstand attacks in court.

Finally, some comments reflected a misunderstanding of EPA's suggestion that states explore with counsel ways to draft their regulations so as to automatically incorporate by reference future additions to Appendix P and avoid the time-consuming plan revision process. (EPA pointed out that public participation would still be assured, since EPA's proposed revisions to Appendix P would always be subject to public comment on a nation-wide basis.)

EPA's purpose was merely to suggest an approach that a state may wish to follow if the approach would be legal under that state's law. EPA offers no opinion as to whether any state law would allow this. Such a determination is up to the individual states.

Summary of Revisions and Clarifications to the Proposed Regulations. Briefly, the revisions and clarifications to the proposed regulations include:

(1) A clarification to indicate that continuous emission monitors are not required for sources unless such sources are subject to an applicable emission limitation of an approved SIP.

(2) A revision to require emission monitors for oxides of nitrogen in only those AQCR's where the Administrator has specifically called for a control strategy for nitrogen dioxide.

(3) A revision to include a general provision to exempt any source that clearly demonstrates that it will cease operation

within five years of the inclusion of monitoring requirements for the source in Appendix P.

(4) Revisions to exempt smaller-sized sources and infrequently used sources within the specified source categories.

(5) A revision to the data reporting requirements to require the submittal by the source of the State, emission data in excess of the applicable emission limitation for both opacity and gaseous pollutants, rather than all measured data, as proposed. A provision has been added to require information on the cause of all noted violations of applicable regulations.

(6) A clarification to indicate that the continuous monitoring of oxygen is not required unless the continuous monitoring of sulfur dioxide and/or nitrogen oxides emissions is required by the applicable SIP.

(7) A revision to allow the placement of continuous emission monitors at "a representative location" on the exhaust gas system rather than at "the most representative location" as required by the proposed regulations.

(8) A revision to delete the requirements of new performance tests each time the continuous monitoring equipment is repaired or modified. However, a new provision is included to require that a report of all repairs and maintenance performed during the quarter shall be reported by the source to the State.

(9) A modification to provide sources 18 months rather than one year after approval or promulgation of the revised SIP to comply with the continuous monitoring regulations adopted by the States.

(10) A modification to provide States one year, rather than the six months after the promulgation of these regulations in the FEDERAL REGISTER to submit plan revisions to satisfy the requirements promulgated herein.

Requirements of States. States shall be required to revise their SIP's by October 6, 1976 to include legally enforceable procedures to require emission monitoring, recording and reporting, as a minimum for those sources specified in the regulations promulgated herein. While minimum requirements have been established, States may, as they deem appropriate, expand these requirements.

The regulations promulgated herein have been revised in light of the various comments to generally provide a more limited introduction into this new methodology. Cooperation among affected parties, i.e., State and local control agencies, sources, instrument manufacturers and suppliers, and this Agency is necessary to move successfully forward in these areas of emission monitoring and reporting prescribed in the Clean Air Act. Assistance can be obtained from the EPA Regional Offices in relation to the technical and procedural aspects of these regulations.

Copies of documents referenced in this Preamble are available for public inspection at the EPA Freedom of Information Center, 401 M Street, S.W., Washington, D.C. 20460. The Agency has not prepared an environmental impact statement for these regulations since they

were proposed (September 11, 1974) prior to the effective date for requiring voluntary environmental impact statements on EPA's regulatory actions (see 39 FR 16186, May 7, 1974).

The regulations set forth below are promulgated under the authority of sections 110(a) (2) (F) (ii)-(iii) and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c-5(a) (2) (F) (ii)-(iii), 1857g (a) 1 and are effective November 5, 1975.

Dated: September 23, 1975.

JOHN QUARLES,
Acting Administrator.

REFERENCES

1. Jenkins, R. E., Strategies and Air Standards Division, OAQPS, EPA. Memo to R. L. Ajax, Emission Standards and Engineering Division, OAQPS, EPA, Emission Monitoring Costs, February 27, 1975.

2. Young, D. E., Control Programs Development Division, OAQPS, EPA. Memo to E. J. Lillis, Control Programs Development Division, OAQPS, EPA, Emission Source Data for In-Stack Monitoring Regulations, June 4, 1975.

1. Section 51.1 is amended by adding paragraphs (z), (aa), (bb), (cc), (dd), and (ee) as follows:

§ 51.1 Definitions.

(z) "Emission standard" means a regulation (or portion thereof) setting forth an allowable rate of emissions, level of opacity, or prescribing equipment or fuel specifications that result in control of air pollution emissions.

(aa) "Capacity factor" means the ratio of the average load on a machine or equipment for the period of time considered to the capacity rating of the machine or equipment.

(bb) "Excess emissions" means emissions of an air pollutant in excess of an emission standard.

(cc) "Nitric acid plant" means any facility producing nitric acid 30 to 70 percent in strength by either the pressure or atmospheric pressure process.

(dd) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide, or acid sludge, but does not include facilities where conversion to sulfuric acid is utilized primarily as a means of preventing emissions to the atmosphere of sulfur dioxide or other sulfur compounds.

(ee) "Fossil fuel-fired steam generator" means a furnace or boiler used in the process of burning fossil fuel for the primary purpose of producing steam by heat transfer.

2. Section 51.19 is amended by adding paragraph (e) as follows:

§ 51.19 Source surveillance.

(e) Legally enforceable procedures to require stationary sources subject to emission standards as part of an applicable plan to install, calibrate, maintain, and operate equipment for continuously monitoring and recording emissions; and to provide other information as specified in Appendix P of this part.

(1) Such procedures shall identify the types of sources, by source category and capacity, that must install such instruments, and shall identify for each source category the pollutants which must be monitored.

(2) Such procedures shall, as a minimum, require the types of sources set forth in Appendix P of this part (as such appendix may be amended from time to time) to meet the applicable requirements set forth therein.

(3) Such procedures shall contain provisions which require the owner or operator of each source subject to continuous emission monitoring and recording requirements to maintain a file of all pertinent information. Such information shall include emission measurements, continuous monitoring system performance testing measurements, performance evaluations, calibration checks, and adjustments and maintenance performed on such monitoring systems and other reports and records required by Appendix P of this Part for at least two years following the date of such measurements or maintenance.

(4) Such procedures shall require the source owner or operator to submit information relating to emissions and operation of the emission monitors to the State to the extent described in Appendix P as frequently or more frequently as described therein.

(5) Such procedures shall provide that sources subject to the requirements of § 51.19(e) (2) of this section shall have installed all necessary equipment and shall have begun monitoring and recording within 18 months of (1) the approval of a State plan requiring monitoring for that source or (2) promulgation by the Agency of monitoring requirements for that source. However, sources that have made good faith efforts to purchase, install, and begin the monitoring and recording of emission data but who have been unable to complete such installation within the time period provided may be given reasonable extensions of time as deemed appropriate by the State.

(6) States shall submit revisions to the applicable plan which implement the provisions of this section by October 6, 1976.

3. In Part 51, Appendix P is added as follows:

APPENDIX P—MINIMUM EMISSION MONITORING REQUIREMENTS

1.0 Purpose. This Appendix P sets forth the minimum requirements for continuous emission monitoring and recording that each State Implementation Plan must include in order to be approved under the provisions of 40 CFR 51.19(e). These requirements include the source categories to be affected; emission monitoring, recording, and reporting requirements for those sources; performance specifications for accuracy, reliability, and durability of acceptable monitoring systems; and techniques to convert emission data to units of the applicable State emission standard. Such data must be reported to the State as an indication of whether proper maintenance and operating procedures are being utilized by source operators to maintain emission levels at or below emission standards. Such data may be used directly or in-

directly for compliance determination or any other purpose deemed appropriate by the State. Though the monitoring requirements are specified in detail, States are given some flexibility to resolve difficulties that may arise during the implementation of these regulations.

1.1 Applicability.

The State plan shall require the owner or operator of an emission source in a category listed in this Appendix to: (1) install, calibrate, operate, and maintain all monitoring equipment necessary for continuously monitoring the pollutants specified in this Appendix for the applicable source category; and (2) complete the installation and performance tests of such equipment and begin monitoring and recording within 18 months of plan approval or promulgation. The source categories and the respective monitoring requirements are listed below.

1.1.1 Fossil fuel-fired steam generators, as specified in paragraph 2.1 of this appendix, shall be monitored for opacity, nitrogen oxides emissions, sulfur dioxide emissions, and oxygen or carbon dioxide.

1.1.2 Fluid bed catalytic cracking unit catalyst regenerators, as specified in paragraph 2.4 of this appendix, shall be monitored for opacity.

1.1.3 Sulfuric acid plants, as specified in paragraph 2.3 of this appendix, shall be monitored for sulfur dioxide emissions.

1.1.4 Nitric acid plants, as specified in paragraph 2.2 of this appendix, shall be monitored for nitrogen oxides emissions.

1.2 Exemptions.

The States may include provisions within their regulations to grant exemptions from the monitoring requirements of paragraph 1.1 of this appendix for any source which is:

1.2.1 subject to a new source performance standard promulgated in 40 CFR Part 60 pursuant to Section 111 of the Clean Air Act; or

1.2.2 not subject to an applicable emission standard of an approved plan; or

1.2.3 scheduled for retirement within 5 years after inclusion of monitoring requirements for the source in Appendix P, provided that adequate evidence and guarantees are provided that clearly show that the source will cease operations prior to such date.

1.3 Extensions.

States may allow reasonable extensions of the time provided for installation of monitors for facilities unable to meet the prescribed timeframe (i.e., 18 months from plan approval or promulgation) provided the owner or operator of such facility demonstrates that good faith efforts have been made to obtain and install such devices within such prescribed timeframe.

1.4 Monitoring System Malfunction.

The State plan may provide a temporary exemption from the monitoring and reporting requirements of this appendix during any period of monitoring system malfunction, provided that the source owner or operator shows, to the satisfaction of the State, that the malfunction was unavoidable and is being repaired as expeditiously as practicable.

2.0 Minimum Monitoring Requirement.

States must, as a minimum, require the sources listed in paragraph 1.1 of this appendix to meet the following basic requirements.

2.1 Fossil fuel-fired steam generators.

Each fossil fuel-fired steam generator, except as provided in the following subparagraphs, with an annual average capacity factor of greater than 30 percent, as reported to the Federal Power Commission for calendar year 1974, or as otherwise demonstrated to the State by the owner or operator, shall conform with the following monitoring requirements when such facility is subject to an emission standard of an applicable plan for the pollutant in question.

2.1.1 A continuous monitoring system for the measurement of opacity which meets the performance specifications of paragraph 3.1.1 of this appendix shall be installed, calibrated, maintained, and operated in accordance with the procedures of this appendix by the owner or operator of any such steam generator of greater than 250 million BTU per hour heat input except where:

2.1.1.1 gaseous fuel is the only fuel burned, or

2.1.1.2 oil or a mixture of gas and oil are the only fuels burned and the source is able to comply with the applicable particulate matter and opacity regulations without utilization of particulate matter collection equipment, and where the source has never been found, through any administrative or judicial proceedings, to be in violation of any visible emission standard of the applicable plan.

2.1.2 A continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of paragraph 3.1.3 of this appendix shall be installed, calibrated, maintained, and operated on any fossil fuel-fired steam generator of greater than 250 million BTU per hour heat input which has installed sulfur dioxide pollutant control equipment.

2.1.3 A continuous monitoring system for the measurement of nitrogen oxides which meets the performance specification of paragraph 3.1.2 of this appendix shall be installed, calibrated, maintained, and operated on fossil fuel-fired steam generators of greater than 1000 million BTU per hour heat input when such facility is located in an Air Quality Control Region where the Administrator has specifically determined that a control strategy for nitrogen dioxide is necessary to attain the national standards, unless the source owner or operator demonstrates during source compliance tests as required by the State that such a source emits nitrogen oxides at levels 30 percent or more below the emission standard within the applicable plan.

2.1.4 A continuous monitoring system for the measurement of the percent oxygen or carbon dioxide which meets the performance specifications of paragraphs 3.1.4 or 3.1.5 of this appendix shall be installed, calibrated, operated, and maintained on fossil fuel-fired steam generators where measurements of oxygen or carbon dioxide in the flue gas are required to convert either sulfur dioxide or nitrogen oxides continuous emission monitoring data, or both, to units of the emission standard within the applicable plan.

2.2 Nitric acid plants.

Each nitric acid plant of greater than 300 tons per day production capacity, the production capacity being expressed as 100 percent acid, located in an Air Quality Control Region where the Administrator has specifically determined that a control strategy for nitrogen dioxide is necessary to attain the national standard shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of nitrogen oxides which meets the performance specifications of paragraph 3.1.2 for each nitric acid producing facility within such plant.

2.3 Sulfuric acid plants.

Each sulfuric acid plant of greater than 300 tons per day production capacity, the production being expressed as 100 percent acid, shall install, calibrate, maintain and operate a continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of 3.1.3 for each sulfuric acid producing facility within such plant.

2.4 Fluid bed catalytic cracking unit catalyst regenerators at petroleum refineries.

Each catalyst regenerator for fluid bed catalytic cracking units of greater than 20,000 barrels per day fresh feed capacity shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of opacity which meets the performance specifications of 3.1.1.

3.0 Minimum specifications.

All State plans shall require owners or operators of monitoring equipment installed to comply with this Appendix, except as provided in paragraph 3.2, to demonstrate compliance with the following performance specifications.

3.1 Performance specifications.

The performance specifications set forth in Appendix B of Part 60 are incorporated herein by reference, and shall be used by States to determine acceptability of monitoring equipment installed pursuant to this Appendix except that (1) where reference is made to the "Administrator" in Appendix B, Part 60, the term "State" should be inserted for the purpose of this Appendix (e.g., in Performance Specification 1, 1.2, "... monitoring systems subject to approval by the Administrator," should be interpreted as, "... monitoring systems subject to approval by the State"), and (2) where reference is made to the "Reference Method" in Appendix B, Part 60, the State may allow the use of either the State approved reference method or the Federally approved reference method as published in Part 60 of this Chapter. The Performance Specifications to be used with each type of monitoring system are listed below.

3.1.1 Continuous monitoring systems for measuring opacity shall comply with Performance Specification 1.

3.1.2 Continuous monitoring systems for measuring nitrogen oxides shall comply with Performance Specification 2.

3.1.3 Continuous monitoring systems for measuring sulfur dioxide shall comply with Performance Specification 2.

3.1.4 Continuous monitoring systems for measuring oxygen shall comply with Performance Specification 3.

3.1.5 Continuous monitoring systems for measuring carbon dioxide shall comply with Performance Specification 3.

3.2 Exemptions.

Any source which has purchased an emission monitoring system(s) prior to September 11, 1974, may be exempt from meeting such test procedures prescribed in Appendix B of Part 60 for a period not to exceed five years from plan approval or promulgation.

3.3 Calibration gases.

For nitrogen oxides monitoring systems installed on fossil fuel-fired steam generators the pollutant gas used to prepare calibration gas mixtures (Section 2.1, Performance Specification 2, Appendix B, Part 60) shall be nitric oxide (NO). For nitrogen oxides monitoring systems installed on nitric acid plants the pollutant gas used to prepare calibration gas mixtures (Section 2.1, Performance Specification 2, Appendix B, Part 60 of this Chapter) shall be nitrogen dioxide (NO₂). These gases shall also be used for daily checks under paragraph 3.7 of this appendix as applicable. For sulfur dioxide monitoring systems installed on fossil fuel-fired steam generators or sulfuric acid plants the pollutant gas used to prepare calibration gas mixtures (Section 2.1, Performance Specification 2, Appendix B, Part 60 of this Chapter) shall be sulfur dioxide (SO₂). Span and zero gases should be traceable to National Bureau of Standards reference gases whenever these reference gases are available. Every six months from date of manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses using the reference methods in Appendix A, Part 60 of this chapter as follows: for sulfur dioxide, use Reference Method 6; for nitrogen oxides, use Reference Method 7;

and for carbon dioxide or oxygen, use Reference Method 3. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.

3.4 Cycling times.

Cycling times include the total time a monitoring system requires to sample, analyze and record an emission measurement.

3.4.1 Continuous monitoring systems for measuring opacity shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 10-second period.

3.4.2 Continuous monitoring systems for measuring oxides of nitrogen, carbon dioxide, oxygen, or sulfur dioxide shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period.

3.5 Monitor location.

State plans shall require all continuous monitoring systems or monitoring devices to be installed such that representative measurements of emissions or process parameters (i.e., oxygen, or carbon dioxide) from the affected facility are obtained. Additional guidance for location of continuous monitoring systems to obtain representative samples are contained in the applicable Performance Specifications of Appendix B of Part 60 of this Chapter.

3.6 Combined effluents.

When the effluents from two or more affected facilities of similar design and operating characteristics are combined before being released to the atmosphere, the State plan may allow monitoring systems to be installed on the combined effluent. When the affected facilities are not of similar design and operating characteristics, or when the effluent from one affected facility is released to the atmosphere through more than one point, the State should establish alternate procedures to implement the intent of these requirements.

3.7 Zero and drift.

State plans shall require owners or operators of all continuous monitoring systems installed in accordance with the requirements of this Appendix to record the zero and span drift in accordance with the method prescribed by the manufacturer of such instruments; to subject the instruments to the manufacturer's recommended zero and span check at least once daily unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations shall be followed; to adjust the zero and span whenever the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in Appendix B of Part 60 are exceeded; and to adjust continuous monitoring systems referenced by paragraph 3.2 of this Appendix whenever the 24-hour zero drift or 24-hour calibration drift exceed 10 percent of the emission standard.

3.8 Span.

Instrument span should be approximately 200 per cent of the expected instrument data display output corresponding to the emission standard for the source.

3.9 Alternative procedures and requirements.

In cases where States wish to utilize different, but equivalent, procedures and requirements for continuous monitoring systems, the State plan must provide a description of such alternative procedures for approval by the Administrator. Some examples of situations that may require alternatives follow:

3.9.1 Alternative monitoring requirements to accommodate continuous monitoring systems that require corrections for stack moisture conditions (e.g., an instrument measuring steam generator SO₂ emissions on a wet basis could be used with an instrument measuring oxygen concentration on a dry basis if acceptable methods of measuring stack moisture conditions are used to allow ac-

curate adjustment of the measured SO₂ concentration to dry basis.)

3.9.2 Alternative locations for installing continuous monitoring systems or monitoring devices when the owner or operator can demonstrate that installation at alternative locations will enable accurate and representative measurements.

3.9.3 Alternative procedures for performing calibration checks (e.g., some instruments may demonstrate superior drift characteristics that require checking at less frequent intervals).

3.9.4 Alternative monitoring requirements when the effluent from one affected facility or the combined effluent from two or more identical affected facilities is released to the atmosphere through more than one point (e.g., an extractive, gaseous monitoring system used at several points may be approved if the procedures recommended are suitable for generating accurate emission averages).

3.9.5 Alternative continuous monitoring systems that do not meet the spectral response requirements in Performance Specification 1, Appendix B of Part 60, but adequately demonstrate a definite and consistent relationship between their measurements and the opacity measurements of a system complying with the requirements in Performance Specification 1. The State may require that such demonstration be performed for each affected facility.

4.0 Minimum data requirements.

The following paragraphs set forth the minimum data reporting requirements necessary to comply with § 51.19(e) (3) and (4).

4.1 The State plan shall require owners or operators of facilities required to install continuous monitoring systems to submit a written report of excess emissions for each calendar quarter and the nature and cause of the excess emissions, if known. The averaging period used for data reporting should be established by the State to correspond to the averaging period specified in the emission test method used to determine compliance with an emission standard for the pollutant/source category in question. The required report shall include, as a minimum, the data stipulated in this Appendix.

4.2 For opacity measurements, the summary shall consist of the magnitude in actual percent opacity of all one-minute (or such other time period deemed appropriate by the State) averages of opacity greater than the opacity standard in the applicable plan for each hour of operation of the facility. Average values may be obtained by integration over the averaging period or by arithmetically averaging a minimum of four equally spaced, instantaneous opacity measurements per minute. Any time period exempted shall be considered before determining the excess averages of opacity (e.g., whenever a regulation allows two minutes of opacity measurements in excess of the standard, the State shall require the source to report all opacity averages, in any one hour, in excess of the standard, minus the two-minute exemption). If more than one opacity standard applies, excess emissions data must be submitted in relation to all such standards.

4.3 For gaseous measurements the summary shall consist of emission averages, in the units of the applicable standard, for each averaging period during which the applicable standard was exceeded.

4.4 The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of system repairs or adjustments shall be reported. The State may require proof of continuous monitoring system performance whenever system repairs or adjustments have been made.

4.5 When no excess emissions have occurred and the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be included in the report.

4.6 The State plan shall require owners or operators of affected facilities to maintain a file of all information reported in the quarterly summaries, and all other data collected either by the continuous monitoring system or as necessary to convert monitoring data to the units of the applicable standard for a minimum of two years from the date of collection of such data or submission of such summaries.

5.0 Data Reduction.

The State plan shall require owners or operators of affected facilities to use the following procedures for converting monitoring data to units of the standard where necessary.

5.1 For fossil fuel-fired steam generators the following procedures shall be used to convert gaseous emission monitoring data in parts per million to g/million cal (lb/million BTU) where necessary:

5.1.1 When the owner or operator of a fossil fuel-fired steam generator elects under subparagraph 2.1.4 of this Appendix to measure oxygen in the flue gases, the measurements of the pollutant concentration and oxygen concentration shall each be on a dry basis and the following conversion procedure used:

$$E = CF \left(\frac{20.9}{20.9 - \%O_2} \right)$$

5.1.2 When the owner or operator elects under subparagraph 2.1.4 of this Appendix to measure carbon dioxide in the flue gases, the measurement of the pollutant concentration and the carbon dioxide concentration shall each be on a consistent basis (wet or dry) and the following conversion procedure used:

$$E = CF \left(\frac{100}{\%CO_2} \right)$$

5.1.3 The values used in the equations under paragraph 5.1 are derived as follows:

E = pollutant emission, g/million cal (lb/million BTU).

C = pollutant concentration, g/dscm (lb/dscf), determined by multiplying the average concentration (ppm) for each hourly period by 4.16×10^{-6} M g/dscm per ppm (2.64×10^{-6} M lb/dscf per ppm) where M = pollutant molecular weight, g/g-mole (lb/lb-mole). M = 64 for sulfur dioxide and 44 for oxides of nitrogen.

%O₂, %CO₂ = Oxygen or carbon dioxide volume (expressed as percent) determined with equipment specified under paragraph 4.1.4 of this appendix.

F, F_c = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (F_c) respectively. Values of F and F_c are given in § 60.45(f) of Part 60, as applicable.

5.2 For sulfuric acid plants the owner or operator shall:

5.2.1 establish a conversion factor three times daily according to the procedures to § 60.84(b) of this chapter;

5.2.2 multiply the conversion factor by the average sulfur dioxide concentration in the

flue gases to obtain average sulfur dioxide emissions in Kg/metric ton (lb/short ton); and

5.2.3 report the average sulfur dioxide emission for each averaging period in excess of the applicable emission standard in the quarterly summary.

5.3 For nitric acid plants the owner or operator shall:

5.3.1 establish a conversion factor according to the procedures of § 60.73(b) of this chapter.

5.3.2 multiply the conversion factor by the average nitrogen oxides concentration in the flue gases to obtain the nitrogen oxides emissions in the units of the applicable standard;

5.3.3 report the average nitrogen oxides emission for each averaging period in excess of the applicable emission standard, in the quarterly summary.

5.4 Any State may allow data reporting or reduction procedures varying from those set forth in this Appendix if the owner or operator of a source shows to the satisfaction of the State that his procedures are at least as accurate as those in this Appendix. Such procedures may include but are not limited to, the following:

5.4.1 Alternative procedures for computing emission averages that do not require integration of data (e.g., some facilities may demonstrate that the variability of their emissions is sufficiently small to allow accurate reduction of data based upon computing averages from equally spaced data points over the averaging period).

5.4.2 Alternative methods of converting pollutant concentration measurements to the units of the emission standards.

6.0 Special Consideration.

The State plan may provide for approval, on a case-by-case basis, of alternative monitoring requirements different from the provisions of Parts 1 through 5 of this Appendix if the provisions of this Appendix (i.e., the installation of a continuous emission monitoring system) cannot be implemented by a source due to physical plant limitations or extreme economic reasons. To make use of this provision, States must include in their plan specific criteria for determining those physical limitations or extreme economic situations to be considered by the State. In such cases, when the State exempts any source subject to this Appendix by use of this provision from installing continuous emission monitoring systems, the State shall set forth alternative emission monitoring and reporting requirements (e.g., periodic manual stack tests) to satisfy the intent of these regulations. Examples of such special cases include, but are not limited to, the following:

6.1 Alternative monitoring requirements may be prescribed when installation of a continuous monitoring system or monitoring device specified by this Appendix would not provide accurate determinations of emissions (e.g., condensed, uncombined water vapor may prevent an accurate determination of opacity using commercially available continuous monitoring systems).

6.2 Alternative monitoring requirements may be prescribed when the affected facility is infrequently operated (e.g., some affected facilities may operate less than one month per year).

6.3 Alternative monitoring requirements may be prescribed when the State determines that the requirements of this Appendix would impose an extreme economic burden on the source owner or operator.

6.4 Alternative monitoring requirements may be prescribed when the State determines that monitoring systems prescribed by this Appendix cannot be installed due to physical limitations at the facility.

[FR Doc.75-26566 Filed 10-3-75;8:45 am]

[FRL 423-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES**Emission Monitoring Requirements and Revisions to Performance Testing Methods**

On September 11, 1974 (39 FR 32852), the Environmental Protection Agency (EPA) proposed revisions to 40 CFR Part 60, Standards of Performance for New Stationary Sources, to establish specific requirements pertaining to continuous emission monitoring system performance specifications, operating procedures, data. These requirements would apply to new and modified facilities covered under Part 60, but would not apply to existing facilities.

Simultaneously (39 FR 32871), the Agency proposed revisions to 40 CFR Part 51, Requirements for the Preparation, Adoption, and Submittal of Implementation Plans, which would require States to revise their State Implementation Plans (SIP's) to include legal enforceable procedures requiring certain specified stationary sources to monitor emissions on a continuous basis. These requirements would apply to existing facilities, which are not covered under Part 60.

Interested parties participated in the rulemaking by sending comments to EPA. A total of 105 comment letters were received on the proposed revisions to Part 60 from monitoring equipment manufacturers, data processing equipment manufacturers, industrial users of monitoring equipment, air pollution control agencies including State, local, and EPA regional offices, other Federal agencies, and consultants. Copies of the comment letters received and a summary of the issues and EPA's responses are available for inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. In addition, copies of the issue summary and EPA responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460 (specify Public Comment Summary: Emission Monitoring Requirements). The comments have been carefully considered, additional information has been collected and assessed, and where determined by the Administrator to be appropriate, changes have been made to the proposed regulations. These changes are incorporated in the regulations promulgated herein.

BACKGROUND

At the time the regulations were proposed (September 11, 1974), EPA had promulgated 12 standards of performance for new stationary sources under section 111 of the Clean Air Act, as amended, four of which required the affected facilities to install and operate systems which continuously monitor the levels of pollutant emissions, where the technical feasibility exists using currently available continuous monitoring technology, and where the cost of the

systems is reasonable. When the four standards that require monitoring systems were promulgated, EPA had limited knowledge about the operation of such systems because only a few systems had been installed; thus, the requirements were specified in general terms. EPA initiated a program to develop performance specifications and obtain information on the operation of continuous monitoring systems. The program was designed to assess the systems' accuracy, reliability, costs, and problems related to installation, operation, maintenance, and data handling. The proposed regulations (39 FR 32852) were based on the results of this program.

The purpose of regulations promulgated herein is to establish minimum performance specifications for continuous monitoring systems, minimum data reduction requirements, operating procedures, and reporting requirements for those affected facilities required to install continuous monitoring systems. The specifications and procedures are designed to assure that the data obtained from continuous monitoring systems will be accurate and reliable and provide the necessary information for determining whether an owner or operator is following proper operation and maintenance procedures.

SIGNIFICANT COMMENTS AND CHANGES MADE TO PROPOSED REGULATIONS

Many of the comment letters received by EPA contained multiple comments. The most significant comments and the differences between the proposed and final regulations are discussed below.

(1) Subpart A—General Provisions. The greatest number of comments received pertained to the methodology and expense of obtaining and reporting continuous monitoring system emission data. Both air pollution control agencies and affected users of monitoring equipment presented the view that the proposed regulations requiring that all emission data be reported were excessive, and that reports of only excess emissions and retention of all the data for two years on the affected facility's premises is sufficient. Twenty-five commentators suggested that the effectiveness of the operation and maintenance of an affected facility and its air pollution control system could be determined by reporting only excess emissions. Fifteen others recommended deleting the reporting requirements entirely.

EPA has reviewed these comments and has contacted vendors of monitoring and data acquisition equipment for additional information to more fully assess the impact of the proposed reporting requirements. Consideration was also given to the resources that would be required of EPA to enforce the proposed requirement, the costs that would be incurred by an affected source, and the effectiveness of the proposed requirement in comparison with a requirement to report only excess emissions. EPA concluded that reporting only excess emissions would assure proper operation and maintenance of the air pollution

control equipment and would result in lower costs to the source and allow more effective use of EPA resources by eliminating the need for handling and storing large amounts of data. Therefore, the regulation promulgated herein requires owners or operators to report only excess emissions and to maintain a permanent record of all emission data for a period of two years.

In addition, the proposed specification of minimum data reduction procedures has been changed. Rather than requiring integrated averages as proposed, the regulations promulgated herein also specify a method by which a minimum number of data points may be used to compute average emission rates. For example, average opacity emissions over a six-minute period may be calculated from a minimum of 24 data points equally spaced over each six-minute period. Any number of equally spaced data points in excess of 24 or continuously integrated data may also be used to compute six-minute averages. This specification of minimum computation requirements combined with the requirement to report only excess emissions provides source owners and operators with maximum flexibility to select from a wide choice of optional data reduction procedures. Sources which monitor only opacity and which infrequently experience excess emissions may choose to utilize strip chart recorders, with or without continuous six-minute integrators; whereas sources monitoring two or more pollutants plus other parameters necessary to convert to units of the emission standard may choose to utilize existing computers or electronic data processes incorporated with the monitoring system. All data must be retained for two years, but only excess emissions need be reduced to units of the standard. However, in order to report excess emissions, adequate procedures must be utilized to insure that excess emissions are identified. Here again, certain sources with minimal excess emissions can determine excess emissions by review of strip charts, while sources with varying emission and excess air rates will most likely need to reduce all data to units of the standard to identify any excess emissions. The regulations promulgated herein allow the use of extractive, gaseous monitoring systems on a time sharing basis by installing sampling probes at several locations, provided the minimum number of data points (four per hour) are obtained.

Several commentators stated that the averaging periods for reduction of monitoring data, especially opacity, were too short and would result in an excessive amount of data that must be reduced and recorded. EPA evaluated these comments and concluded that to be useful to source owners and operators as well as enforcement agencies, the averaging time for the continuous monitoring data should be reasonably consistent with the averaging time for the reference methods used during performance tests. The data reduction requirements for opacity have been substantially reduced because the averaging period was changed from one

minute, which was proposed, to six minutes to be consistent with revisions made to Method 9 (39 FR 39872).

Numerous comments were received on proposed § 60.13 which resulted in several changes. The proposed section has been reorganized and revised in several respects to accommodate the comments and provide clarity, to more specifically delineate the equipment subject to Performance Specifications in Appendix B, and to more specifically define requirements for equipment purchased prior to September 11, 1974. The provisions in § 60.13 are not intended to prevent the use of any equipment that can be demonstrated to be reliable and accurate; therefore, the performance of monitoring systems is specified in general terms with minimal references to specific equipment types. The provisions in § 60.13(i) are included to allow owners or operators and equipment vendors to apply to the Administrator for approval to use alternative equipment or procedures when equipment capable of producing accurate results may not be commercially available (e.g. condensed water vapor interferes with measurement of opacity), when unusual circumstances may justify less costly procedures, or when the owner or operator or equipment vendor may simply prefer to use other equipment or procedures that are consistent with his current practices.

Several paragraphs in § 60.13 have been changed on the basis of the comments received. In response to comments that the monitor operating frequency requirements did not consider periods when the monitor is inoperative or undergoing maintenance, calibration, and adjustment, the operating frequency requirements have been changed. Also the frequency of cycling requirement for opacity monitors has been changed to be consistent with the response time requirement in Performance Specification 1, which reflects the capability of commercially available equipment.

A second area that received comment concerns maintenance performed upon continuous monitoring systems. Six commentators noted that the proposed regulation requiring extensive retesting of continuous monitoring systems for all minor failures would discourage proper maintenance of the systems. Two other commentators noted the difficulty of determining a general list of critical components, the replacement of which would automatically require a retest of the system. Nevertheless, it is EPA's opinion that some control must be exercised to insure that a suitable monitoring system is not rendered unsuitable by substantial alteration or a lack of needed maintenance. Accordingly, the regulations promulgated herein require that owners or operators submit with the quarterly report information on any repairs or modifications made to the system during the reporting period. Based upon this information, the Administrator may review the status of the monitoring system with the owner or operator and, if determined to be necessary, require retesting of the continuous monitoring system(s).

Several commentators noted that the proposed reporting requirements are unnecessary for affected facilities not required to install continuous monitoring systems. Consequently, the regulations promulgated herein do not contain the requirements.

Numerous comments were received which indicated that some monitoring systems may not be compatible with the proposed test procedures and requirements. The comments were evaluated and, where appropriate, the proposed test procedures and requirements were changed. The procedures and requirements promulgated herein are applicable to the majority of acceptable systems; however, EPA recognizes that there may be some acceptable systems available now or in the future which could not meet the requirements. Because of this, the regulations promulgated herein include a provision which allows the Administrator to approve alternative testing procedures. Eleven commentators noted that adjustment of the monitoring instruments may not be necessary as a result of daily zero and span checks. Accordingly, the regulations promulgated herein require adjustments only when applicable 24-hour drift limits are exceeded. Four commentators stated that it is not necessary to introduce calibration gases near the probe tips. EPA has demonstrated in field evaluations that this requirement is necessary in order to assure accurate results; therefore, the requirement has been retained. The requirement enables detection of any dilution or absorption of pollutant gas by the plumbing and conditioning systems prior to the pollutant gas entering the gas analyzer.

Provisions have been added to these regulations to require that the gas mixtures used for the daily calibration check of extractive continuous monitoring systems be traceable to National Bureau of Standards (NBS) reference gases. Calibration gases used to conduct system evaluations under Appendix B must either be analyzed prior to use or shown to be traceable to NBS materials. This traceability requirement will assure the accuracy of the calibration gas mixtures and the comparability of data from systems at all locations. These traceability requirements will not be applied whenever the NBS materials are not available. A list of available NBS Standard Reference Materials may be obtained from the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

Recertification of the continued accuracy of the calibration gas mixtures is also necessary and should be performed at intervals recommended by the calibration gas mixture manufacturer. The NBS materials and calibration gas mixtures traceable to these materials should not be used after expiration of their stated shelf-life. Manufacturers of calibration gas mixtures generally use NBS materials for traceability purposes, therefore, these amendments to the reg-

ulations will not impose additional requirements upon most manufacturers.

(2) Subpart D—Fossil-Fuel Fired Steam Generators. Eighteen commentators had questions or remarks concerning the proposed revisions dealing with fuel analysis. The evaluation of these comments and discussions with coal suppliers and electric utility companies led the Agency to conclude that the proposed provisions for fuel analysis are not adequate or consistent with the current fuel situation. An attempt was made to revise the proposed provisions; however, it became apparent that an in-depth study would be necessary before meaningful provisions could be developed. The Agency has decided to promulgate all of the regulations except those dealing with fuel analysis. The fuel analysis provisions of Subpart D have been reserved in the regulations promulgated herein. The Agency has initiated a study to obtain the necessary information on the variability of sulfur content in fuels, and the capability of fossil fuel fired steam generators to use fuel analysis and blending to prevent excess sulfur dioxide emissions. The results of this study will be used to determine whether fuel analysis should be allowed as a means of measuring excess emissions, and if allowed, what procedure should be required. It should be pointed out that this action does not affect facilities which use flue gas desulfurization as a means of complying with the sulfur dioxide standard; these facilities are still required to install continuous emission monitoring systems for sulfur dioxide. Facilities which use low sulfur fuel as a means of complying with the sulfur dioxide standard may use a continuous sulfur dioxide monitor or fuel analysis. For facilities that elect to use fuel analysis procedures, fuels are not required to be sampled or analyzed for preparation of reports of excess emissions until the Agency finalizes the procedures and requirements.

Three commentators recommended that carbon dioxide continuous monitoring systems be allowed as an alternative for oxygen monitoring for measurement of the amount of diluents in flue gases from steam generators. The Agency agrees with this recommendation and has included a provision which allows the use of carbon dioxide monitors. This provision allows the use of pollutant monitors that produce data on a wet basis without requiring additional equipment or procedures for correction of data to a dry basis. Where CO₂ or O₂ data are not collected on a consistent basis (wet or dry) with the pollutant data, or where oxygen is measured on a wet basis, alternative procedures to provide corrections for stack moisture and excess air must be approved by the Administrator. Similarly, use of a carbon dioxide continuous monitoring system downstream of a flue gas desulfurization system is not permitted without the Administrator's prior approval due to the potential for absorption of CO₂ within the control device. It should be noted that when any fuel is fired directly in the stack gases

for reheating, the F and F_c factors promulgated herein must be prorated based upon the total heat input of the fuels fired within the facility regardless of the locations of fuel firing. Therefore, any facility using a flue gas desulfurization system may be limited to dry basis monitoring instrumentation due to the restrictions on use of a CO_2 diluent monitor unless water vapor is also measured subject to the Administrator's approval.

Two commentators requested that an additional factor (F_w) be developed for use with oxygen continuous monitoring systems that measure flue gas diluents on a wet basis. A factor of this type was evaluated by EPA, but is not being promulgated with the regulations herein. The error in the accuracy of the factor may exceed ± 5 percent without additional measurements to correct for variations in flue gas moisture content due to fluctuations in ambient humidity or fuel moisture content. However, EPA will approve installation of wet basis oxygen systems on a case-by-case basis if the owner or operator will proposed use of additional measurements and procedures to control the accuracy of the F_w factor within acceptable limits. Applications for approval of such systems should include the frequency and type of additional measurements proposed and the resulting accuracy of the F_w factor under the extremes of operating conditions anticipated.

One commentator stated that the proposed requirements for recording heat input are superfluous because this information is not needed to convert monitoring data to units of the applicable standard. EPA has reevaluated this requirement and has determined that the conversion of excess emissions into units of the standards will be based upon the F factors and that measurement of the rates of fuel firing will not be needed except when combinations of fuels are fired. Accordingly, the regulations promulgated herein require such measurements only when multiple fuels are fired.

Thirteen commentators questioned the rationale for the proposed increased operating temperature of the Method 5 sampling train for fossil-fuel-fired steam generator particulate testing and the basis for raising rather than lowering the temperature. A brief discussion of the rationale behind this revision was provided in the preamble to the proposed regulations, and a more detailed discussion is provided here. Several factors are of primary importance in developing the data base for a standard of performance and in specifying the reference method for use in conducting a performance test, including:

a. The method used for data gathering to establish a standard must be the same as, or must have a known relationship to, the method subsequently established as the reference method.

b. The method should measure pollutant emissions indicative of the performance of the best systems of emission reduction. A method meeting this criterion will not necessarily measure emissions as they would exist after dilution and

cooling to ambient temperature and pressure, as would occur upon release to the atmosphere. As such, an emission factor obtained through use of such a method would, for example, not necessarily be of use in an ambient dispersion model. This seeming inconsistency results from the fact that standards of performance are intended to result in installation of systems of emission reduction which are consistent with best demonstrated technology, considering cost. The Administrator, in establishing such standards, is required to identify best demonstrated technology and to develop standards which reflect such technology. In order for these standards to be meaningful, and for the required control technology to be predictable, the compliance methods must measure emissions which are indicative of the performance of such systems.

c. The method should include sufficient detail as needed to produce consistent and reliable test results.

EPA relies primarily upon Method 5 for gathering a consistent data base for particulate matter standards. Method 5 meets the above criteria by providing detailed sampling methodology and includes an out-of-stack filter to facilitate temperature control. The latter is needed to define particulate matter on a common basis since it is a function of temperature and is not an absolute quantity. If temperature is not controlled, and/or if the effect of temperature upon particulate formation is unknown, the effect on an emission control limitation for particulate matter may be variable and unpredictable.

Although selection of temperature can be varied from industry to industry, EPA specifies a nominal sampling temperature of $120^\circ C$ for most source categories subject to standards of performance. Reasons for selection of $120^\circ C$ include the following:

a. Filter temperature must be held above $100^\circ C$ at sources where moist gas streams are present. Below $100^\circ C$, condensation can occur with resultant plugging of filters and possible gas/liquid reactions. A temperature of $120^\circ C$ allows for expected temperature variation within the train, without dropping below $100^\circ C$.

b. Matter existing in particulate form at $120^\circ C$ is indicative of the performance of the best particulate emission reduction systems for most industrial processes. These include systems of emission reduction that may involve not only the final control device, but also the process and stack gas conditioning systems.

c. Adherence to one established temperature (even though some variation may be needed for some source categories) allows comparison of emissions from source category to source category. This limited standardization used in the development of standards of performance is a benefit to equipment vendors and to source owners by providing a consistent basis for comparing test results and predicting control system performance. In comparison, in-stack filtration takes place at stack temperature, which usually

is not constant from one source to the next. Since the temperature varies, in-stack filtration does not necessarily provide a consistent definition of particulate matter and does not allow for comparison of various systems of control. On these bases, Method 5 with a sampling filter temperature controlled at approximately $120^\circ C$ was promulgated as the applicable test method for new fossil-fuel fired steam generators.

Subsequent to the promulgation of the standards of performance for steam generators, data became available indicating that certain combustion products which do not exist as particulate matter at the elevated temperatures existing in steam generator stacks may be collected by Method 5 at lower temperatures (below $160^\circ C$). Such material, existing in gaseous form at stack temperature, would not be controllable by emission reduction systems involving electrostatic precipitators (ESP). Consequently, measurement of such condensable matter would not be indicative of the control system performance. Studies conducted in the past two years have confirmed that such condensation can occur. At sources where fuels containing 0.3 to 0.85 percent sulfur were burned, the incremental increase in particulate matter concentration resulting from sampling at $120^\circ C$ as compared to about $150^\circ C$ was found to be variable, ranging from 0.001 to 0.008 gr/scf. The variability is not necessarily predictable, since total sulfur oxide concentration, boiler design and operation, and fuel additives each appear to have a potential effect. Based upon these data, it is concluded that the potential increase in particulate concentration at sources meeting the standard of performance for sulfur oxides is not a serious problem in comparison with the particulate standard which is approximately 0.07 gr/scf. Nevertheless, to insure that an unusual case will not occur where a high concentration of condensable matter, not controllable with an ESP, would prevent attainment of the particulate standard, the sampling temperature allowed at fossil-fuel fired steam boilers is being raised to $160^\circ C$. Since this temperature is attainable at new steam generator stacks, sampling at temperatures above $160^\circ C$ would not yield results necessarily representative of the capabilities of the best systems of emission reduction.

In evaluating particulate sampling techniques and the effect of sampling temperature, particular attention has also been given to the possibility that SO_2 may react in the front half of the Method 5 train to form particulate matter. Based upon a series of comprehensive tests involving both source and controlled environments, EPA has developed data that show such reactions do not occur to a significant degree.

Several control agencies commented on the increase in sampling temperature and suggested that the need is for sampling at lower, not higher, temperatures. This is a relevant comment and is one which must be considered in terms of the basis upon which standards are established.

For existing boilers which are not subject to this standard, the existence of higher stack temperatures and/or the use of higher sulfur fuels may result in significant condensation and resultant high indicated particulate concentrations when sampling is conducted at 120° C. At one coal fired steam generator burning coal containing approximately three percent sulfur, EPA measurements at 120° C showed an increase of 0.05 gr/dscf over an average of seven runs compared to samples collected at approximately 150° C. It is believed that this increase resulted, in large part, if not totally, from SO₂ condensation which would occur also when the stack emissions are released into the atmosphere. Therefore, where standards are based upon emission reduction to achieve ambient air quality standards rather than on control technology (as is the case with the standards promulgated herein), a lower sampling temperature may be appropriate.

Seven commentators questioned the need for traversing for oxygen at 12 points within a duct during performance tests. This requirement, which is being revised to apply only when particulate sampling is performed (no more than 12 points are required) is included to insure that potential stratification resulting from air in-leakage will not adversely affect the accuracy of the particulate test.

Eight commentators stated that the requirement for continuous monitoring of nitrogen oxides should be deleted because only two air quality control regions have ambient levels of nitrogen dioxide that exceed the national ambient air quality standard for nitrogen dioxide. Standards of performance issued under section 111 of the Act are designed to require affected facilities to design and install the best systems of emission reduction (taking into account the cost of such reduction). Continuous emission monitoring systems are required to insure that the emission control systems are operated and maintained properly. Because of this, the Agency does not feel that it is appropriate to delete the continuous emission monitoring system requirements for nitrogen oxides; however, in evaluating these comments the Agency found that some situations may exist where the nitrogen oxides monitor is not necessary to insure proper operation and maintenance. The quantity of nitrogen oxides emitted from certain types of furnaces is considerably below the nitrogen oxides emission limitation. The low emission level is achieved through the design of the furnace and does not require specific operating procedures or maintenance on a continuous basis to keep the nitrogen oxides emissions below the applicable standard. Therefore, in this situation, a continuous emission monitoring system for nitrogen oxides is unnecessary. The regulations promulgated herein do not require continuous emission monitoring systems for nitrogen oxides on facilities whose emissions are 30 percent or more below the applicable standard.

Three commentators requested that owners or operators of steam generators be permitted to use NO_x continuous monitoring systems capable of measuring only nitric oxide (NO) since the amount of nitrogen dioxide (NO₂) in the flue gases is comparatively small. The regulations proposed and those promulgated herein allow use of such systems or any system meeting all of the requirements of Performance Specification 2 of Appendix B. A system that measures only nitric oxide (NO) may meet these specifications including the relative accuracy requirement (relative to the reference method tests which measure NO + NO₂) without modification. However, in the interests of maximizing the accuracy of the system and creating conditions favorable to acceptance of such systems (the cost of systems measuring only NO is less), the owner or operator may determine the proportion of NO₂ relative to NO in the flue gases and use a factor to adjust the continuous monitoring system emission data (e.g. $1.03 \times \text{NO} = \text{NO}_x$) provided that the factor is applied not only to the performance evaluation data, but also applied consistently to all data generated by the continuous monitoring system thereafter. This procedure is limited to facilities that have less than 10 percent NO₂ (greater than 90 percent NO) in order to not seriously impair the accuracy of the system due to NO₂ to NO proportion fluctuations.

Section 60.45(g) (1) has been reserved for the future specification of the excess emissions for opacity that must be reported. On November 12, 1974 (39 FR 39872), the Administrator promulgated revisions to Subpart A, General Provisions, pertaining to the opacity provisions and to Reference Method 9, Visual Determination of the Opacity of Emissions from Stationary Sources. On April 22, 1975 (40 FR 17778), the Agency issued a notice soliciting comments on the opacity provisions and Reference Method 9. The Agency intends to evaluate the comments received and make any appropriate revision to the opacity provisions and Reference Method 9. In addition, the Agency is evaluating the opacity standards for fossil-fuel fired steam generators under § 60.42(a) (2) to determine if changes are needed because of the new Reference Method 9. The provisions on excess emissions for opacity will be issued after the Agency completes its evaluation of the opacity standard.

(3) Subpart G—Nitric Acid Plants. Two commentators questioned the long-term validity of the proposed conversion procedures for reducing data to units of the standard. They suggested that the conversion could be accomplished by monitoring the flue gas volumetric rate. EPA reevaluated the proposed procedures and found that monitoring the flue gas volume would be the most direct method and would also be an accurate method of converting monitoring data, but would require the installation of an additional continuous monitoring system. Although this option is available and would be acceptable subject to the Administrator's approval, EPA does not believe that the

additional expense this method (monitoring volumetric rate) would entail is warranted. Since nitric acid plants, for economic and technical reasons, typically operate within a fairly narrow range of conversion efficiencies (90-96 percent) and tail gas diluents (2-5 percent oxygen), the flue gas volumetric rates are reasonably proportional to the acid production rate. The error that would be introduced into the data from the maximum variation of these parameters is approximately 15 percent and would usually be much less. It is expected that the tail gas oxygen concentration (an indication of the degree of tail gas dilution) will be rigidly controlled at facilities using catalytic converter control equipment. Accordingly, the proposed procedures for data conversion have been retained due to the small benefit that would result from requiring additional monitoring equipment. Other procedures may be approved by the Administrator under § 60.13(d).

(4) Subpart H—Sulfuric Acid Plants. Two commentators stated that the proposed procedure for conversion of monitoring data to units of the standard would result in large data reduction errors. EPA has evaluated more closely the operations of sulfuric acid plants and agrees that the proposed procedure is inadequate. The proposed conversion procedure assumes that the operating conditions of the affected facility will remain approximately the same as during the continuous monitoring system evaluation tests. For sulfuric acid plants this assumption is invalid. A sulfuric acid plant is typically designed to operate at a constant volumetric throughput (scfm). Acid production rates are altered by by-passing portions of the process air around the furnace or combustor to vary the concentration of the gas entering the converter. This procedure produces widely varying amounts of tail gas dilution relative to the production rate. Accordingly, EPA has developed new conversion procedures whereby the appropriate conversion factor is computed from an analysis of the SO₂ concentration entering the converter. Air injection plants must make additional corrections for the diluent air added. Measurement of the inlet SO₂ is a normal quality control procedure used by most sulfuric acid plants and does not represent an additional cost burden. The Reich test or other suitable procedures may be used.

(5) Subpart J—Petroleum Refineries. One commentator stated that the requirements for installation of continuous monitoring systems for oxygen and firebox temperature are unnecessary and that installation of a flame detection device would be superior for process control purposes. Also, EPA has obtained data which show no identifiable relationship between furnace temperature, percent oxygen in the flue gas, and carbon monoxide emissions when the facility is operated in compliance with the applicable standard. Since firebox temperature and oxygen measurements may not be preferred by source owners and operators for process control, and no

known method is available for translation of these measurements into quantitative reports of excess carbon monoxide emissions, this requirement appears to be of little use to the affected facilities or to EPA. Accordingly, requirements for installation of continuous monitoring systems for measurements of firebox temperature and oxygen are deleted from the regulations.

Since EPA has not yet developed performance specifications for carbon monoxide or hydrogen sulfide continuous monitoring systems, the type of equipment that may be installed by an owner or operator in compliance with EPA requirements is undefined. Without conducting performance evaluations of such equipment, little reliance can be placed upon the value of any data such systems would generate. Therefore, the sections of the regulation requiring these systems are being reserved until EPA proposes performance specifications applicable to H₂S and CO monitoring systems. The provisions of § 60.105(a)(3) do not apply to an owner or operator electing to monitor H₂S. In that case, an H₂S monitor should not be installed until specific H₂S monitoring requirements are promulgated. At the time specifications are proposed, all owners or operators who have not entered into binding contractual obligations to purchase continuous monitoring equipment by [date of publication] will be required to install a carbon monoxide continuous monitoring system and a hydrogen sulfide continuous monitoring system (unless a sulfur dioxide continuous monitoring system has been installed) as applicable.

Section 60.105(a)(2), which specifies the excess emissions for capacity that must be reported, has been reserved for the same reasons discussed under fossil fuel-fired steam generators.

(6) Appendix B—Performance Specifications. A large number of comments were received in reference to specific technical and editorial changes needed in the specifications. Each of these comments has been reviewed and several changes in format and procedures have been made. These include adding alignment procedures for opacity monitors and more specific instructions for selecting a location for installing the monitoring equipment. Span requirements have been specified so that commercially produced equipment may be standardized where possible. The format of the specifications was simplified by redefining the requirements in terms of percent opacity, or oxygen, or carbon dioxide, or percent of span. The proposed requirements were in terms of percent of the emission standard which is less convenient or too vague since reference to the emission standards would have represented a range of pollutant concentrations depending upon the amount of diluents (i.e. excess air and water vapor) that are present in the effluent. In order to calibrate gaseous monitors in terms of a specific concentration, the requirements were revised to delete reference to the emission standards.

Four commentators noted that the reference methods used to evaluate con-

tinuous monitoring system performance may be less accurate than the systems themselves. Five other commentators questioned the need for 27 nitrogen oxides reference method tests. The accuracy specification for gaseous monitoring systems was specified at 20 percent, a value in excess of the actual accuracy of monitoring systems that provides tolerance for reference method inaccuracy. Commercially available monitoring equipment has been evaluated using these procedures and the combined errors (i.e. relative accuracy) in the reference methods and the monitoring systems have been shown not to exceed 20 percent after the data are averaged by the specified procedures.

Twenty commentators noted that the cost estimates contained in the proposal did not fully reflect installation costs, data reduction and recording costs, and the costs of evaluating the continuous monitoring systems. As a result, EPA reevaluated the cost analysis. For opacity monitoring alone, investment costs including data reduction equipment and performance tests are approximately \$20,000, and annual operating costs are approximately \$8,500. The same location on the stack used for conducting performance tests with Reference Method 5 (particulate) may be used by installing a separate set of ports for the monitoring system so that no additional expense for access is required. For power plants that are required to install opacity, nitrogen oxides, sulfur dioxide, and diluent (O₂ or CO₂) monitoring systems, the investment cost is approximately \$55,000, and the operating cost is approximately \$30,000. These are significant costs but are not unreasonable in comparison to the approximately seven million dollar investment cost for the smallest steam generation facility affected by these regulations.

Effective date. These regulations are promulgated under the authority of sections 111, 114 and 301(a) of the Clean Air Act as amended [42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)] and become effective October 6, 1975.

Dated: September 23, 1975.

JOHN QUARLES,
Acting Administrator.

40 CFR Part 60 is amended by revising Subparts A, D, F, G, H, I, J, L, M, and O, and adding Appendix B as follows:

1. The table of sections is amended by revising Subpart A and adding Appendix B as follows:

Subpart A—General Provisions

60.13 Monitoring requirements.

APPENDIX B—PERFORMANCE SPECIFICATIONS

Performance Specification 1—Performance specifications and specification test procedures for transmissometer systems for continuous measurement of the opacity of stack emissions.

Performance Specification 2—Performance specifications and specification test procedures for monitors of SO₂ and NO_x from stationary sources.

Performance Specification 3—Performance specifications and specification test proce-

dures for monitors of CO₂ and O₂ from stationary sources.

Subpart A—General Provisions

Section 60.2 is amended by revising paragraph (r) and by adding paragraphs (x), (y), and (z) as follows:

§ 60.2 Definitions.

(r) "One-hour period" means any 60 minute period commencing on the hour.

(x) "Six-minute period" means any one of the 10 equal parts of a one-hour period.

(y) "Continuous monitoring system" means the total equipment, required under the emission monitoring sections in applicable subparts, used to sample and condition (if applicable), to analyze, and to provide a permanent record of emissions or process parameters.

(z) "Monitoring device" means the total equipment, required under the monitoring of operations sections in applicable subparts, used to measure and record (if applicable) process parameters.

3. In § 60.7, paragraph (a)(5) is added and paragraphs (b), (c), and (d) are revised. The added and revised provisions read as follows:

§ 60.7 Notification and record keeping.

(5) A notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with § 60.13(c). Notification shall be postmarked not less than 30 days prior to such date.

(b) Any owner or operator subject to the provisions of this part shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.

(c) Each owner or operator required to install a continuous monitoring system shall submit a written report of excess emissions (as defined in applicable subparts) to the Administrator for every calendar quarter. All quarterly reports shall be postmarked by the 30th day following the end of each calendar quarter and shall include the following information:

(1) The magnitude of excess emissions computed in accordance with § 60.13(h), any conversion factor(s) used, and the date and time of commencement and completion of each time period of excess emissions.

(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventative measures adopted.

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.

(4) When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.

(d) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by this part recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records.

4. A new § 60.13 is added as follows:

§ 60.13 Monitoring requirements.

(a) Unless otherwise approved by the Administrator or specified in applicable subparts, the requirements of this section shall apply to all continuous monitoring systems required under applicable subparts.

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to conducting performance tests under § 60.8. Verification of operational status shall, as a minimum, consist of the following:

(1) For continuous monitoring systems referenced in paragraph (c) (1) of this section, completion of the conditioning period specified by applicable requirements in Appendix B.

(2) For continuous monitoring systems referenced in paragraph (c) (2) of this section, completion of seven days of operation.

(3) For monitoring devices referenced in applicable subparts, completion of the manufacturer's written requirements or recommendations for checking the operation or calibration of the device.

(c) During any performance tests required under § 60.8 or within 30 days thereafter and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of any affected facility shall conduct continuous monitoring system performance evaluations and furnish the Administrator within 60 days thereof two or, upon request, more copies of a written report of the results of such tests. These continuous monitoring system performance evaluations shall be conducted in accordance with the following specifications and procedures:

(1) Continuous monitoring systems listed within this paragraph except as provided in paragraph (c) (2) of this section shall be evaluated in accordance with the requirements and procedures contained in the applicable performance

specification of Appendix B as follows:

(i) Continuous monitoring systems for measuring opacity of emissions shall comply with Performance Specification 1.

(ii) Continuous monitoring systems for measuring nitrogen oxides emissions shall comply with Performance Specification 2.

(iii) Continuous monitoring systems for measuring sulfur dioxide emissions shall comply with Performance Specification 2.

(iv) Continuous monitoring systems for measuring the oxygen content or carbon dioxide content of effluent gases shall comply with Performance Specification 3.

(2) An owner or operator who, prior to September 11, 1974, entered into a binding contractual obligation to purchase specific continuous monitoring system components except as referenced by paragraph (c) (2) (iii) of this section shall comply with the following requirements:

(i) Continuous monitoring systems for measuring opacity of emissions shall be capable of measuring emission levels within ± 20 percent with a confidence level of 95 percent. The Calibration Error Test and associated calculation procedures set forth in Performance Specification 1 of Appendix B shall be used for demonstrating compliance with this specification.

(ii) Continuous monitoring systems for measurement of nitrogen oxides or sulfur dioxide shall be capable of measuring emission levels within ± 20 percent with a confidence level of 95 percent. The Calibration Error Test, the Field Test for Accuracy (Relative), and associated operating and calculation procedures set forth in Performance Specification 2 of Appendix B shall be used for demonstrating compliance with this specification.

(iii) Owners or operators of all continuous monitoring systems installed on an affected facility prior to [date of promulgation] are not required to conduct tests under paragraphs (c) (2) (i) and/or (ii) of this section unless requested by the Administrator.

(3) All continuous monitoring systems referenced by paragraph (c) (2) of this section shall be upgraded or replaced (if necessary) with new continuous monitoring systems, and such improved systems shall be demonstrated to comply with applicable performance specifications under paragraph (c) (1) of this section by September 11, 1979.

(d) Owners or operators of all continuous monitoring systems installed in accordance with the provisions of this part shall check the zero and span drift at least once daily in accordance with the method prescribed by the manufacturer of such systems unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. The zero and span shall, as a minimum, be adjusted whenever the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in Appendix B are exceeded. For continuous

monitoring systems measuring opacity of emissions, the optical surfaces exposed to the effluent gases shall be cleaned prior to performing the zero or span drift adjustments except that for systems using automatic zero adjustments, the optical surfaces shall be cleaned when the cumulative automatic zero compensation exceeds four percent opacity. Unless otherwise approved by the Administrator, the following procedures, as applicable, shall be followed:

(1) For extractive continuous monitoring systems measuring gases, minimum procedures shall include introducing applicable zero and span gas mixtures into the measurement system as near the probe as is practical. Span and zero gases certified by their manufacturer to be traceable to National Bureau of Standards reference gases shall be used whenever these reference gases are available. The span and zero gas mixtures shall be the same composition as specified in Appendix B of this part. Every six months from date of manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses with Reference Methods 6 for SO_2 , 7 for NO_x , and 3 for O_2 and CO_2 , respectively. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.

(2) For non-extractive continuous monitoring systems measuring gases, minimum procedures shall include upscale check(s) using a certified calibration gas cell or test cell which is functionally equivalent to a known gas concentration. The zero check may be performed by computing the zero value from upscale measurements or by mechanically producing a zero condition.

(3) For continuous monitoring systems measuring opacity of emissions, minimum procedures shall include a method for producing a simulated zero opacity condition and an upscale (span) opacity condition using a certified neutral density filter or other related technique to produce a known obscuration of the light beam. Such procedures shall provide a system check of the analyzer internal optical surfaces and all electronic circuitry including the lamp and photodetector assembly.

(e) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under paragraph (d) of this section, all continuous monitoring systems shall be in continuous operation and shall meet minimum frequency of operation requirements as follows:

(1) All continuous monitoring systems referenced by paragraphs (c) (1) and (2) of this section for measuring opacity of emissions shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 10-second period.

(2) All continuous monitoring systems referenced by paragraph (c) (1) of this section for measuring oxides of nitrogen, sulfur dioxide, carbon dioxide, or oxygen shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period.

(3) All continuous monitoring systems referenced by paragraph (c) (2) of this section, except opacity, shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive one-hour period.

(f) All continuous monitoring systems or monitoring devices shall be installed such that representative measurements of emissions or process parameters from the affected facility are obtained. Additional procedures for location of continuous monitoring systems contained in the applicable Performance Specifications of Appendix B of this part shall be used.

(g) When the effluents from a single affected facility or two or more affected facilities subject to the same emission standards are combined before being released to the atmosphere, the owner or operator may install applicable continuous monitoring systems on each effluent or on the combined effluent. When the affected facilities are not subject to the same emission standards, separate continuous monitoring systems shall be installed on each effluent. When the effluent from one affected facility is released to the atmosphere through more than one point, the owner or operator shall install applicable continuous monitoring systems on each separate effluent unless the installation of fewer systems is approved by the Administrator.

(h) Owners or operators of all continuous monitoring systems for measurement of opacity shall reduce all data to six-minute averages and for systems other than opacity to one-hour averages for time periods under § 60.2 (x) and (r) respectively. Six-minute opacity averages shall be calculated from 24 or more data points equally spaced over each six-minute period. For systems other than opacity, one-hour averages shall be computed from four or more data points equally spaced over each one-hour period. Data recorded during periods of system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph. An arithmetic or integrated average of all data may be used. The data output of all continuous monitoring systems may be recorded in reduced or nonreduced form (e.g., ppm pollutant and percent O₂ or lb/million Btu of pollutant). All excess emissions shall be converted into units of the standard using the applicable conversion procedures specified in subparts. After conversion into units of the standard, the data may be rounded to the same number of significant digits used in subparts to specify the applicable standard (e.g., rounded to the nearest one percent opacity).

(1) Upon written application by an owner or operator, the Administrator may approve alternatives to any monitoring procedures or requirements of this part including, but not limited to the following:

(i) Alternative monitoring requirements when installation of a continuous monitoring system or monitoring device specified by this part would not provide

accurate measurements due to liquid water or other interferences caused by substances with the effluent gases.

(ii) Alternative monitoring requirements when the affected facility is infrequently operated.

(iii) Alternative monitoring requirements to accommodate continuous monitoring systems that require additional measurements to correct for stack moisture conditions.

(iv) Alternative locations for installing continuous monitoring systems or monitoring devices when the owner or operator can demonstrate that installation at alternate locations will enable accurate and representative measurements.

(v) Alternative methods of converting pollutant concentration measurements to units of the standards.

(vi) Alternative procedures for performing daily checks of zero and span drift that do not involve use of span gases or test cells.

(vii) Alternatives to the A.S.T.M. test methods or sampling procedures specified by any subpart.

(viii) Alternative continuous monitoring systems that do not meet the design or performance requirements in Performance Specification 1, Appendix B, but adequately demonstrate a definite and consistent relationship between its measurements and the measurements of opacity by a system complying with the requirements in Performance Specification 1. The Administrator may require that such demonstration be performed for each affected facility.

(ix) Alternative monitoring requirements when the effluent from a single affected facility or the combined effluent from two or more affected facilities are released to the atmosphere through more than one point.

Subpart D—Standards of Performance for Fossil Fuel-Fired Steam Generators

§ 60.42 [Amended]

5. Paragraph (a) (2) of § 60.42 is amended by deleting the second sentence.

6. Section 60.45 is amended by revising paragraphs (a), (b), (c), (d), (e), (f), and (g) as follows:

§ 60.45 Emission and fuel monitoring.

(a) A continuous monitoring system for measuring the opacity of emissions, except where gaseous fuel is the only fuel burned, shall be installed, calibrated, maintained, and operated by the owner or operator. The continuous monitoring system shall be spanned at 80 or 90 or 100 percent opacity.

(b) A continuous monitoring system for measuring sulfur dioxide emissions, shall be installed, calibrated, maintained and operated by the owner or operator except where gaseous fuel is the only fuel burned or where low sulfur fuels are used to achieve compliance with the standard under § 60.43 and fuel analyses under paragraph (b) (2) of this section are conducted. The following procedures shall be used for monitoring sulfur dioxide emissions:

(1) For affected facilities which use continuous monitoring systems, Reference Method 6 shall be used for conducting monitoring system performance evaluations under § 60.13(c). The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO₂). The span value for the continuous monitoring system shall be determined as follows:

(i) For affected facilities firing liquid fossil fuel the span value shall be 1000 ppm sulfur dioxide.

(ii) For affected facilities firing solid fossil fuel the span value shall be 1500 ppm sulfur dioxide.

(iii) For affected facilities firing fossil fuels in any combination, the span value shall be determined by computation in accordance with the following formula and rounding to the nearest 500 ppm sulfur dioxide:

$$1000y + 1500z$$

where:

y = the fraction of total heat input derived from liquid fossil fuel, and

z = the fraction of total heat input derived from solid fossil fuel.

(iv) For affected facilities which fire both fossil fuels and nonfossil fuels, the span value shall be subject to the Administrator's approval.

(2) [Reserved]

(3) For affected facilities using flue gas desulfurization systems to achieve compliance with sulfur dioxide standards under § 60.43, the continuous monitoring system for measuring sulfur dioxide emissions shall be located downstream of the desulfurization system and in accordance with requirements in Performance Specification 2 of Appendix B and the following:

(i) Owners or operators shall install CO₂ continuous monitoring systems, if selected under paragraph (d) of this section, at a location upstream of the desulfurization system. This option may be used only if the owner or operator can demonstrate that air is not added to the flue gas between the CO₂ continuous monitoring system and the SO₂ continuous monitoring system and each system measures the CO₂ and SO₂ on a dry basis.

(ii) Owners or operators who install O₂ continuous monitoring systems under paragraph (d) of this section shall select a location downstream of the desulfurization system and all measurements shall be made on a dry basis.

(iii) If fuel of a different type than is used in the boiler is fired directly into the flue gas for any purpose (e.g., reheating) the F or Fc factors used shall be prorated under paragraph (f) (6) of this section with consideration given to the fraction of total heat input supplied by the additional fuel. The pollutant, opacity, CO₂, or O₂ continuous monitoring system(s) shall be installed downstream of any location at which fuel is fired directly into the flue gas.

(c) A continuous monitoring system for the measurement of nitrogen oxides emissions shall be installed, calibrated, maintained, and operated by the owner

or operator except for any affected facility demonstrated during performance tests under § 60.8 to emit nitrogen oxides pollutants at levels 30 percent or more below applicable standards under § 60.44 of this part. The following procedures shall be used for determining the span and for calibrating nitrogen oxides continuous monitoring systems:

(1) The span value shall be determined as follows:

(i) For affected facilities firing gaseous fossil fuel the span value shall be 500 ppm nitrogen oxides.

(ii) For affected facilities firing liquid fossil fuel the span value shall be 500 ppm nitrogen oxides.

(iii) For affected facilities firing solid fossil fuel the span value shall be 1000 ppm nitrogen oxides.

(iv) For affected facilities firing fossil fuels in any combination, the span value shall be determined by computation in accordance with the following formula and rounding to the nearest 500 ppm nitrogen oxides:

$$500(x+y)+1000z$$

where:

x = the fraction of total heat input derived from gaseous fossil fuel,

y = the fraction of total heat input derived from liquid fossil fuel, and

z = the fraction of total heat input derived from solid fossil fuel.

(v) For affected facilities which fire both fossil fuels and nonfossil fuels, the span value shall be subject to the Administrator's approval.

(2) The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13 (d) to this part, shall be nitric oxide (NO). Reference Method 7 shall be used for conducting monitoring system performance evaluations under § 60.13(c).

(d) A continuous monitoring system for measuring either oxygen or carbon dioxide in the flue gases shall be installed, calibrated, maintained, and operated by the owner or operator.

(e) An owner or operator required to install continuous monitoring systems under paragraphs (b) and (c) of this section shall for each pollutant monitored use the applicable conversion procedure for the purpose of converting continuous monitoring data into units of the applicable standards (g/million cal, lb/million Btu) as follows:

(1) When the owner or operator elects under paragraph (d) of this section to measure oxygen in the flue gases, the measurement of the pollutant concentration and oxygen concentration shall each be on a dry basis and the following conversion procedure shall be used:

$$E = CF \left(\frac{20.9}{20.9 - \%O_2} \right)$$

where:

E, C, F and $\%O_2$ are determined under paragraph (f) of this section.

(2) When the owner or operator elects under paragraph (d) of this section to measure carbon dioxide in the flue gases, the measurement of the pollutant concentration and the carbon dioxide concentration shall be on a consistent basis

(wet or dry) and the following conversion procedure shall be used:

$$E = CF_e \left[\frac{100}{\%CO_2} \right]$$

where:

E, C, F_e , and $\%CO_2$ are determined under paragraph (f) of this section.

(f) The values used in the equations under paragraphs (e) (1) and (2) of this section are derived as follows:

(1) E = pollutant emission, g/million cal (lb/million Btu).

(2) C = pollutant concentration, g/dscm (lb/dscf), determined by multiplying the average concentration (ppm) for each one-hour period by 4.15×10^{-4} M g/dscm per ppm (2.59×10^{-4} M lb/dscf per ppm) where M = pollutant molecular weight, g/g-mole (lb/lb-mole). M = 64.07 for sulfur dioxide and 46.01 for nitrogen oxides.

(3) $\%O_2$, $\%CO_2$ = oxygen or carbon dioxide volume (expressed as percent), determined with equipment specified under paragraph (d) of this section.

(4) F, F_e = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (F_e), respectively. Values of F and F_e are given as follows:

$$F = \left[\frac{227.0\%H + 95.7\%C + 35.4\%S + 8.6\%N - 28.5\%O}{GCV} \right] \text{ (metric units)}$$

$$F_e = \frac{10^6 [6.34\%H + 1.53\%C + 0.57\%S + 0.14\%N - 0.46\%O]}{GCV} \text{ (English units)}$$

$$F_e = \frac{20.0\%C}{GCV} \text{ (metric units)}$$

$$F_e = \frac{321 \times 10^6 \%C}{GCV} \text{ (English units)}$$

(i) H, C, S, N, and O are content by weight of hydrogen, carbon, sulfur, nitrogen, and oxygen (expressed as percent), respectively, as determined on the same basis as GCV by ultimate analysis of the fuel fired, using A.S.T.M. method D3178-74 or D3176 (solid fuels), or computed from results using A.S.T.M. methods D1137-53(70), D1945-64(73), or D1946-67(72) (gaseous fuels) as applicable.

(ii) GCV is the gross calorific value (cal/g, Btu/lb) of the fuel combusted, determined by the A.S.T.M. test methods D2015-66(72) for solid fuels and D1826-64(70) for gaseous fuels as applicable.

(6) For affected facilities firing combinations of fossil fuels, the F or F_e factors determined by paragraphs (f) (4) or (5) of this section shall be prorated in accordance with the applicable formula as follows:

$$(1) F = xF_1 + yF_2 + zF_3$$

where:

x, y, z = the fraction of total heat input derived from gaseous, liquid, and solid fuel, respectively.

F_1, F_2, F_3 = the value of F for gaseous, liquid, and solid fossil fuels respectively under paragraphs (f) (4) or (5) of this section.

(i) For anthracite coal as classified according to A.S.T.M. D388-66, $F = 1.139$ dscm/million cal (10140 dscf/million Btu) and $F_e = 0.222$ scm CO_2 /million cal (1980 scf CO_2 /million Btu).

(ii) For sub-bituminous and bituminous coal as classified according to ASTM D388-66, $F = 1.103$ dscm/million cal (9820 dscf/million Btu) and $F_e = 0.203$ scm CO_2 /million cal (1810 scf CO_2 /million Btu).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, $F = 1.036$ dscm/million cal (9220 dscf/million Btu) and $F_e = 0.161$ scm CO_2 /million cal (1430 scf CO_2 /million Btu).

(iv) For gaseous fossil fuels, $F = 0.982$ dscm/million cal (8740 dscf/million Btu). For natural gas, propane, and butane fuels, $F_e = 0.117$ scm CO_2 /million cal (1040 scf CO_2 /million Btu) for natural gas, 0.135 scm CO_2 /million cal (1200 scf CO_2 /million Btu) for propane, and 0.142 scm CO_2 /million cal (1260 scf CO_2 /million Btu) for butane.

(5) The owner or operator may use the following equation to determine an F factor (dscm/million cal, or dscf/million Btu) on a dry basis (if it is desired to calculate F on a wet basis, consult with the Administrator) or F_e factor (scm CO_2 /million cal, or scf CO_2 /million Btu) on either basis in lieu of the F or F_e factors specified in paragraph (f) (4) of this section:

$$F = \left[\frac{227.0\%H + 95.7\%C + 35.4\%S + 8.6\%N - 28.5\%O}{GCV} \right] \text{ (metric units)}$$

$$F_e = \frac{10^6 [6.34\%H + 1.53\%C + 0.57\%S + 0.14\%N - 0.46\%O]}{GCV} \text{ (English units)}$$

$$F_e = \frac{20.0\%C}{GCV} \text{ (metric units)}$$

$$F_e = \frac{321 \times 10^6 \%C}{GCV} \text{ (English units)}$$

$$(ii) F_e = \sum_{i=1}^n X_i (F_e)_i$$

where:

X_i = the fraction of total heat input derived from each type fuel (e.g., natural gas, butane, crude, bituminous coal, etc.).

$(F_e)_i$ = the applicable F_e factor for each fuel type determined in accordance with paragraphs (f) (4) and (5) of this section.

(iii) For affected facilities which fire both fossil fuels and nonfossil fuels, the F or F_e value shall be subject to the Administrator's approval.

(g) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) [Reserved]

(2) Sulfur dioxide. Excess emissions for affected facilities are defined as:

(i) Any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the applicable standard under § 60.43.

(ii) [Reserved]

(3) Nitrogen oxides. Excess emissions for affected facilities using a continuous monitoring system for measuring nitro-

gen oxides are defined as any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) exceed the applicable standards under § 60.44.

7. Section 60.46 is revised to read as follows:

§ 60.46 Test methods and procedures.

(a) The reference methods in Appendix A of this part, except as provided in § 60.8(b), shall be used to determine compliance with the standards as prescribed in §§ 60.42, 60.43, and 60.44 as follows:

(1) Method 1 for selection of sampling site and sample traverses.

(2) Method 3 for gas analysis to be used when applying Reference Methods 5, 6 and 7.

(3) Method 5 for concentration of particulate matter and the associated moisture content.

(4) Method 6 for concentration of SO₂ and

(5) Method 7 for concentration of NO_x.

(b) For Method 5, Method 1 shall be used to select the sampling site and the number of traverse sampling points. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller sampling times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator. The probe and filter holder heating systems in the sampling train shall be set to provide a gas temperature no greater than 160° C (320° F).

(c) For Methods 6 and 7, the sampling site shall be the same as that selected for Method 5. The sampling point in the duct shall be at the centroid of the cross section or at a point no closer to the walls than 1 m (3.28 ft). For Method 6, the sample shall be extracted at a rate proportional to the gas velocity at the sampling point.

(d) For Method 6, the minimum sampling time shall be 20 minutes and the minimum sampling volume 0.02 dscm (0.71 dscf) for each sample. The arithmetic mean of two samples shall constitute one run. Samples shall be taken at approximately 30-minute intervals.

(e) For Method 7, each run shall consist of at least four grab samples taken at approximately 15-minute intervals. The arithmetic mean of the samples shall constitute the run value.

(f) For each run using the methods specified by paragraphs (a) (3), (4), and (5) of this section, the emissions expressed in g/million cal (lb/million Btu) shall be determined by the following procedure:

$$E = CF \left(\frac{20.9}{20.9 - \%O_2} \right)$$

where:

(1) E = pollutant emission g/million cal (lb/million Btu).

(2) C = pollutant concentration, g/dscm (lb/dscf), determined by Methods 5, 6, or 7.

(3) %O₂ = oxygen content by volume (expressed as percent), dry basis. Percent

oxygen shall be determined by using the integrated or grab sampling and analysis procedures of Method 3 as applicable. The sample shall be obtained as follows:

(i) For determination of sulfur dioxide and nitrogen oxides emissions, the oxygen sample shall be obtained simultaneously at the same point in the duct as used to obtain the samples for Methods 6 and 7 determinations, respectively [§ 60.46(c) 1]. For Method 7, the oxygen sample shall be obtained using the grab sampling and analysis procedures of Method 3.

(ii) For determination of particulate emissions, the oxygen sample shall be obtained simultaneously by traversing the duct at the same sampling location used for each run of Method 5 under paragraph (b) of this section. Method 1 shall be used for selection of the number of traverse points except that no more than 12 sample points are required.

(4) F = a factor as determined in paragraphs (f) (4), (5) or (6) of § 60.45.

(g) When combinations of fossil fuels are fired, the heat input, expressed in cal/hr (Btu/hr), shall be determined during each testing period by multiplying the gross calorific value of each fuel fired by the rate of each fuel burned. Gross calorific value shall be determined in accordance with A.S.T.M. methods D2015-66(72) (solid fuels), D240-64(73) (liquid fuels), or D1826-64(70) (gaseous fuels) as applicable. The rate of fuels burned during each testing period shall be determined by suitable methods and shall be confirmed by a material balance over the steam generation system.

Subpart F—Standards of Performance for Portland Cement Plants

§ 60.62 [Amended]

8. Section 60.62 is amended by deleting paragraph (d).

Subpart G—Standards of Performance for Nitric Acid Plants

§ 60.72 [Amended]

9. Paragraph (a) (2) of § 60.72 is amended by deleting the second sentence.

10. Section 60.73 is amended by revising paragraphs (a), (b), (c), and (e) to read as follows:

§ 60.73 Emission monitoring.

(a) A continuous monitoring system for the measurement of nitrogen oxides shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be nitrogen dioxide (NO₂). The span shall be set at 500 ppm of nitrogen dioxide. Reference Method 7 shall be used for conducting monitoring system performance evaluations under § 60.13(c).

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be established by measuring emis-

sions with the continuous monitoring system concurrent with measuring emissions with the applicable reference method tests. Using only that portion of the continuous monitoring emission data that represents emission measurements concurrent with the reference method test periods, the conversion factor shall be determined by dividing the reference method test data averages by the monitoring data averages to obtain a ratio expressed in units of the applicable standard to units of the monitoring data, i.e., kg/metric ton per ppm (lb/short ton per ppm). The conversion factor shall be re-established during any performance test under § 60.8 or any continuous monitoring system performance evaluation under § 60.13(c).

(c) The owner or operator shall record the daily production rate and hours of operation.

(e) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as any three-hour period during which the average nitrogen oxides emissions (arithmetic average of three contiguous one-hour periods) as measured by a continuous monitoring system exceed the standard under § 60.72(a).

Subpart H—Standards of Performance for Sulfuric Acid Plants

§ 60.83 [Amended]

11. Paragraph (a) (2) of § 60.83 is amended by deleting the second sentence.

12. Section 60.84 is amended by revising paragraphs (a), (b), (c), and (e) to read as follows:

§ 60.84 Emission monitoring.

(a) A continuous monitoring system for the measurement of sulfur dioxide shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO₂). Reference Method 8 shall be used for conducting monitoring system performance evaluations under § 60.13(c) except that only the sulfur dioxide portion of the Method 8 results shall be used. The span shall be set at 1000 ppm of sulfur dioxide.

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be determined, as a minimum, three times daily by measuring the concentration of sulfur dioxide entering the converter using suitable methods (e.g., the Reich test, National Air Pollution Control Administration Publication No. 999-AP-13 and calculating the appropriate conversion factor for each eight-hour period as follows:

$$CF = k \left[\frac{1.000 - 0.015r}{r - s} \right]$$

where:

CF = conversion factor (kg/metric ton per ppm, lb/short ton per ppm).

k = constant derived from material balance. For determining CF in metric units, $k=0.0653$. For determining CF in English units, $k=0.1306$.

r = percentage of sulfur dioxide by volume entering the gas converter. Appropriate corrections must be made for air injection plants subject to the Administrator's approval.

s = percentage of sulfur dioxide by volume in the emissions to the atmosphere determined by the continuous monitoring system required under paragraph (a) of this section.

(c) The owner or operator shall record all conversion factors and values under paragraph (b) of this section from which they were computed (i.e., CF, r, and s).

(e) For the purpose of reports under § 60.7(c), periods of excess emissions shall be all three-hour periods (or the arithmetic average of three consecutive one-hour periods) during which the integrated average sulfur dioxide emissions exceed the applicable standards under § 60.82.

Subpart I—Standards of Performance for Asphalt Concrete Plants

§ 60.92 [Amended]

13. Paragraph (a)(2) of § 60.92 is amended by deleting the second sentence.

Subpart J—Standards of Performance for Petroleum Refineries

§ 60.102 [Amended]

14. Paragraph (a)(2) of § 60.102 is amended by deleting the second sentence.

15. Section 60.105 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§ 60.105 Emission monitoring.

(a) Continuous monitoring systems shall be installed, calibrated, maintained, and operated by the owner or operator as follows:

(1) A continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator. The continuous monitoring system shall be spanned at 60, 70, or 80 percent opacity.

(2) [Reserved]

(3) A continuous monitoring system for the measurement of sulfur dioxide in the gases discharged into the atmosphere from the combustion of fuel gases (except where a continuous monitoring system for the measurement of hydrogen sulfide is installed under paragraph (a) (4) of this section). The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO₂). The span shall be set at 100 ppm. For conducting monitoring system performance evaluations under § 60.13(c), Reference Method 6 shall be used.

(4) [Reserved]

(b) [Reserved]

(e) For the purpose of reports under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) [Reserved]

(2) [Reserved]

(3) [Reserved]

(4) Any six-hour period during which the average emissions (arithmetic average of six contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the standard under § 60.104.

Subpart L—Standards of Performance for Secondary Lead Smelters

§ 60.122 [Amended]

16. Section 60.122 is amended by deleting paragraph (c).

Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

§ 60.132 [Amended]

17. Section 60.132 is amended by deleting paragraph (c).

Subpart O—Standards of Performance for Sewage Treatment Plants

§ 60.152 [Amended]

18. Paragraph (a)(2) of § 60.152 is amended by deleting the second sentence.

19. Part 60 is amended by adding Appendix B as follows:

APPENDIX B—PERFORMANCE SPECIFICATIONS

Performance Specification 1—Performance specifications and specification test procedures for transmissometer systems for continuous monitoring system exceed the emissions.

1. Principle and Applicability.

1.1 Principle. The opacity of particulate matter in stack emissions is measured by a continuously operating emission measurement system. These systems are based upon the principle of transmissometry which is a direct measurement of the attenuation of visible radiation (opacity) by particulate matter in a stack effluent. Light having specific spectral characteristics is projected from a lamp across the stack of a pollutant source to a light sensor. The light is attenuated due to absorption and scatter by the particulate matter in the effluent. The percentage of visible light attenuated is defined as the opacity of the emission. Transparent stack emissions that do not attenuate light will have a transmittance of 100 or an opacity of 0. Opaque stack emissions that attenuate all of the visible light will have a transmittance of 0 or an opacity of 100 percent. The transmissometer is evaluated by use of neutral density filters to determine the precision of the continuous monitoring system. Tests of the system are performed to determine zero drift, calibration drift, and response time characteristics of the system.

1.2 Applicability. This performance specification is applicable to the continuous monitoring systems specified in the subparts for measuring opacity of emissions. Specifications for continuous measurement of visible emissions are given in terms of design,

performance, and installation parameters. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator.

2. Apparatus.

2.1 Calibrated Filters. Optical filters with neutral spectral characteristics and known optical densities to visible light or screens known to produce specified optical densities. Calibrated filters with accuracies certified by the manufacturer to within ± 3 percent opacity shall be used. Filters required are low, mid, and high-range filters with nominal optical densities as follows when the transmissometer is spanned at opacity levels specified by applicable subparts:

Span value (percent opacity)	Calibrated filter optical densities with equivalent opacity in parenthesis		
	Low- range	Mid- range	High- range
50.....	0.1 (20)	0.2 (37)	0.3 (50)
60.....	0.1 (20)	0.2 (37)	0.3 (50)
70.....	0.1 (20)	0.3 (50)	0.4 (60)
80.....	0.1 (20)	0.3 (50)	0.6 (75)
90.....	0.1 (20)	0.4 (60)	0.7 (80)
100.....	0.1 (20)	0.4 (60)	0.9 (87.5)

It is recommended that filter calibrations be checked with a well-collimated photopic transmissometer of known linearity prior to use. The filters shall be of sufficient size to attenuate the entire light beam of the transmissometer.

2.2 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with the analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

2.3 Opacity measurement System. An in-stack transmissometer (folded or single path) with the optical design specifications designated below, associated control units and apparatus to keep optical surfaces clean.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of pollutant opacity in a source effluent. Continuous monitoring systems consist of major subsystems as follows:

3.1.1 Sampling Interface. The portion of a continuous monitoring system for opacity that protects the analyzer from the effluent.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant and generates a signal output that is a function of the pollutant opacity.

3.1.3 Data Recorder. That portion of the continuous monitoring system that processes the analyzer output and provides a permanent record of the output signal in terms of pollutant opacity.

3.2 Transmissometer. The portions of a continuous monitoring system for opacity that include the sampling interface and the analyzer.

3.3 Span. The value of opacity at which the continuous monitoring system is set to produce the maximum data display output. The span shall be set at an opacity specified in each applicable subpart.

3.4 Calibration Error. The difference between the opacity reading indicated by the continuous monitoring system and the known values of a series of test standards. For this method the test standards are a series of calibrated optical filters or screens.

3.5 Zero Drift. The change in continuous monitoring system output over a stated period of time of normal continuous operation

when the pollutant concentration at the time of the measurements is zero.

3.6 Calibration Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time of the measurements is the same known upscale value.

3.7 System Response. The time interval from a step change in opacity in the stack at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is reached as displayed on the continuous monitoring system data recorder.

3.8 Operational Test Period. A minimum period of time over which a continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.9 Transmittance. The fraction of incident light that is transmitted through an optical medium of interest.

3.10 Opacity. The fraction of incident light that is attenuated by an optical medium of interest. Opacity (O) and transmittance (T) are related as follows:

$$O = 1 - T$$

3.11 Optical Density. A logarithmic measure of the amount of light that is attenuated by an optical medium of interest. Optical density (D) is related to the transmittance and opacity as follows:

$$D = -\log_{10} T$$

$$D = -\log_{10} (1 - O)$$

3.12 Peak Optical Response. The wavelength of maximum sensitivity of the instrument.

3.13 Mean Spectral Response. The wavelength which bisects the total area under the curve obtained pursuant to paragraph 9.2.1.

3.14 Angle of View. The maximum (total) angle of radiation detection by the photodetector assembly of the analyzer.

3.15 Angle of Projection. The maximum (total) angle that contains 95 percent of the radiation projected from the lamp assembly of the analyzer.

3.16 Pathlength. The depth of effluent in the light beam between the receiver and the transmitter of the single-pass transmissometer, or the depth of effluent between the transceiver and reflector of a double-pass transmissometer. Two pathlengths are referenced by this specification:

3.16.1 Monitor Pathlength. The depth of effluent at the installed location of the continuous monitoring system.

3.16.2 Emission Outlet Pathlength. The depth of effluent at the location emissions are released to the atmosphere.

4. Installation Specification.

4.1 Location. The transmissometer must be located across a section of duct or stack that will provide a particulate matter flow through the optical volume of the transmissometer that is representative of the particulate matter flow through the duct or stack. It is recommended that the monitor pathlength or depth of effluent for the transmissometer include the entire diameter of the duct or stack. In installations using a shorter pathlength, extra caution must be used in determining the measurement location representative of the particulate matter flow through the duct or stack.

4.1.1 The transmissometer location shall be downstream from all particulate control equipment.

4.1.2 The transmissometer shall be located as far from bends and obstructions as practical.

4.1.3 A transmissometer that is located in the duct or stack following a bend shall be installed in the plane defined by the bend where possible.

4.1.4 The transmissometer should be installed in an accessible location.

4.1.5 When required by the Administrator, the owner or operator of a source must demonstrate that the transmissometer is located in a section of duct or stack where a representative particulate matter distribution exists. The determination shall be accomplished by examining the opacity profile of the effluent at a series of positions across the duct or stack while the plant is in operation at maximum or reduced operating rates or by other tests acceptable to the Administrator.

4.2 Slotted Tube. Installations that require the use of a slotted tube shall use a slotted tube of sufficient size and blackness so as not to interfere with the free flow of effluent through the entire optical volume of the transmissometer or reflect light into the transmissometer photodetector. Light reflections may be prevented by using blackened baffles within the slotted tube to prevent the lamp radiation from impinging upon the tube walls, by restricting the angle of projection of the light and the angle of view of the photodetector assembly to less than the cross-sectional area of the slotted tube, or by other methods. The owner or operator must show that the manufacturer of the monitoring system has used appropriate methods to minimize light reflections for systems using slotted tubes.

4.3 Data Recorder Output. The continuous monitoring system output shall permit expanded display of the span opacity on a standard 0 to 100 percent scale. Since all opacity standards are based on the opacity of the effluent exhausted to the atmosphere, the system output shall be based upon the emission outlet pathlength and permanently recorded. For affected facilities whose monitor pathlength is different from the facility's emission outlet pathlength, a graph shall be provided with the installation to show the relationships between the continuous monitoring system recorded opacity based upon the emission outlet pathlength and the opacity of the effluent at the analyzer location (monitor pathlength). Tests for measurement of opacity that are required by this performance specification are based upon the monitor pathlength. The graph necessary to convert the data recorder output to the monitor pathlength basis shall be established as follows:

$$\log (1 - O_2) = (1/L_2) \log (1 - O_1)$$

where:

O_1 = the opacity of the effluent based upon L_1 .

O_2 = the opacity of the effluent based upon L_2 .

L_1 = the emission outlet pathlength.

L_2 = the monitor pathlength.

5. Optical Design Specifications.

The optical design specifications set forth in Section 6.1 shall be met in order for a measurement system to comply with the requirements of this method.

6. Determination of Conformance with Design Specifications.

6.1 The continuous monitoring system for measurement of opacity shall be demonstrated to conform to the design specifications set forth as follows:

6.1.1 Peak Spectral Response. The peak spectral response of the continuous monitoring systems shall occur between 500 nm and 600 nm. Response at any wavelength below 400 nm or above 700 nm shall be less than 10 percent of the peak response of the continuous monitoring system.

6.1.2 Mean Spectral Response. The mean spectral response of the continuous monitoring system shall occur between 500 nm and 600 nm.

6.1.3 Angle of View. The total angle of view shall be no greater than 5 degrees.

6.1.4 Angle of Projection. The total angle of projection shall be no greater than 5 degrees.

6.2 Conformance with requirements under Section 6.1 of this specification may be demonstrated by the owner or operator of the affected facility or by the manufacturer of the opacity measurement system. Where conformance is demonstrated by the manufacturer, certification that the tests were performed, a description of the test procedures, and the test results shall be provided by the manufacturer. If the source owner or operator demonstrates conformance, the procedures used and results obtained shall be reported.

6.3 The general test procedures to be followed to demonstrate conformance with Section 6 requirements are given as follows: (These procedures will not be applicable to all designs and will require modification in some cases. Where analyzer and optical design is certified by the manufacturer to conform with the angle of view or angle of projection specifications, the respective procedures may be omitted.)

6.3.1 Spectral Response. Obtain spectral data for detector, lamp, and filter components used in the measurement system from their respective manufacturers.

6.3.2 Angle of View. Set the received up as specified by the manufacturer. Draw an arc with radius of 3 meters. Measure the receiver response to a small (less than 3 centimeters) non-directional light source at 5-centimeter intervals on the arc for 20 centimeters on either side of the detector centerline. Repeat the test in the vertical direction.

6.3.3 Angle of Projection. Set the projector up as specified by the manufacturer. Draw an arc with radius of 3 meters. Using a small photoelectric light detector (less than 3 centimeters), measure the light intensity at 5-centimeter intervals on the arc for 20 centimeters on either side of the light source centerline of projection. Repeat the test in the vertical direction.

7. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 1-1 to be considered acceptable under this method.

TABLE 1-1.—Performance specifications

Parameter	Specifications
a. Calibration error.....	<3 pct opacity. ¹
b. Zero drift (24 h).....	<2 pct opacity. ¹
c. Calibration drift (24 h).....	<2 pct opacity. ¹
d. Response time.....	10 s (maximum).
e. Operational test period.....	168 h.

¹ Expressed as sum of absolute mean value and the 95 pct confidence interval of a series of tests.

8. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 7:

8.1 Calibration Error and Response Time Test. These tests are to be performed prior to installation of the system on the stack and may be performed at the affected facility or at other locations provided that proper notification is given. Set up and calibrate the measurement system as specified by the manufacturer's written instructions for the monitor pathlength to be used in the installation. Span the analyzer as specified in applicable subparts.

8.1.1 Calibration Error Test. Insert a series of calibration filters in the transmissometer path at the midpoint. A minimum of three calibration filters (low, mid, and high-range) selected in accordance with the table under paragraph 2.1 and calibrated within 3 percent must be used. Make a total of five nonconsecutive readings for each filter.

Record the measurement system output readings in percent opacity. (See Figure 1-1.)

8.1.2 System Response Test. Insert the high-range filter in the transmissometer path five times and record the time required for the system to respond to 95 percent of final zero and high-range filter values. (See Figure 1-2.)

8.2 Field Test for Zero Drift and Calibration Drift. Install the continuous monitoring system on the affected facility and perform the following alignments:

8.2.1 Preliminary Alignments. As soon as possible after installation and once a year thereafter when the facility is not in operation, perform the following optical and zero alignments:

8.2.1.1 Optical Alignment. Align the light beam from the transmissometer upon the optical surfaces located across the effluent (i.e., the retroreflector or photodetector as applicable) in accordance with the manufacturer's instructions.

8.2.1.2 Zero Alignment. After the transmissometer has been optically aligned and the transmissometer mounting is mechanically stable (i.e., no movement of the mounting due to thermal contraction of the stack, duct, etc.) and a clean stack condition has been determined by a steady zero opacity condition, perform the zero alignment. This alignment is performed by balancing the continuous monitor system response so that any simulated zero check coincides with an actual zero check performed across the monitor pathlength of the clean stack.

8.2.1.3 Span. Span the continuous monitoring system at the opacity specified in subparts and offset the zero setting at least 10 percent of span so that negative drift can be quantified.

8.2.2 Final Alignments. After the preliminary alignments have been completed and the affected facility has been started up and reaches normal operating temperature, recheck the optical alignment in accordance with 8.2.1.1 of this specification. If the alignment has shifted, realign the optics, record any detectable shift in the opacity measured by the system that can be attributed to the optical realignment, and notify the Administrator. This condition may not be objectionable if the affected facility operates within a fairly constant and adequately narrow range of operating temperatures that does not produce significant shifts in optical alignment during normal operation of the facility. Under circumstances where the facility operations produce fluctuations in the effluent gas temperature that result in significant misalignments, the Administrator may require improved mounting structures or another location for installation of the transmissometer.

8.2.3 Conditioning Period. After completing the post-startup alignments, operate the system for an initial 168-hour conditioning period in a normal operational manner.

8.2.4 Operational Test Period. After completing the conditioning period, operate the system for an additional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed or calibrated. At 24-hour intervals the zero and span shall be checked according to the manufacturer's instructions. Minimum procedures used shall provide a system check of the analyzer internal mirrors and all electronic circuitry including the lamp and photodetector assembly and shall include a procedure for producing a simulated zero opacity condition and a simulated upscale (span) opacity condition as viewed by the receiver. The manufacturer's written instructions may be used providing that they equal or exceed these minimum procedures. Zero and span the transmissometer, clean all optical surfaces exposed to the effluent, realign optics, and make any necessary adjustments to the calibration of the system daily. These zero and calibration adjustments and optical realignments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention are allowable at any time. The magnitude of any zero or span drift adjustments shall be recorded. During this 168-hour operational test period, record the following at 24-hour intervals: (a) the zero reading and span readings after the system is calibrated (these readings should be set at the same value at the beginning of each 24-hour period); (b) the zero reading after each 24 hours of operation, but before cleaning and adjustment; and (c) the span reading after cleaning and zero adjustment, but before span adjustment. (See Figure 1-3.)

9. Calculation, Data Analysis, and Reporting.

9.1 Procedure for Determination of Mean Values and Confidence Intervals.

9.1.1 The mean value of the data set is calculated according to equation 1-1.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad \text{Equation 1-1}$$

where x_i = absolute value of the individual measurements,

Σ = sum of the individual values,

\bar{x} = mean value, and

n = number of data points.

9.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 1-2:

$$C.I._{95} = \frac{t_{95}}{n\sqrt{n-1}} \sqrt{n(\Sigma x_i^2) - (\Sigma x_i)^2} \quad \text{Equation 1-2}$$

where

Σx_i = sum of all data points,

$t_{95} = t_{1-\alpha/2}$, and

$C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.

Values for t_{95}

n	t_{95}	n	t_{95}
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

The values in this table are already corrected for $n-1$ degrees of freedom. Use n equal to the number of samples as data points.

9.2 Data Analysis and Reporting.

9.2.1 Spectral Response. Combine the spectral data obtained in accordance with paragraph 6.3.1 to develop the effective spectral response curve of the transmissometer. Report the wavelength at which the peak response occurs, the wavelength at which the mean response occurs, and the maximum response at any wavelength below 400 nm and above 700 nm expressed as a percentage of the peak response as required under paragraph 6.2.

9.2.2 Angle of View. Using the data obtained in accordance with paragraph 6.3.2, calculate the response of the receiver as a function of viewing angle in the horizontal and vertical directions (26 centimeters of arc with a radius of 3 meters equal 5 degrees). Report relative angle of view curves as required under paragraph 6.2.

9.2.3 Angle of Projection. Using the data obtained in accordance with paragraph 6.3.3, calculate the response of the photoelectric detector as a function of projection angle in the horizontal and vertical directions. Report relative angle of projection curves as required under paragraph 6.2.

9.2.4 Calibration Error. Using the data from paragraph 8.1 (Figure 1-1), subtract the known filter opacity value from the value shown by the measurement system for each of the 15 readings. Calculate the mean and 95 percent confidence interval of the five different values at each test filter value according to equations 1-1 and 1-2. Report the sum of the absolute mean difference and the 95 percent confidence interval for each of the three test filters.

9.2.5 Zero Drift. Using the zero opacity values measured every 24 hours during the field test (paragraph 8.2), calculate the differences between the zero point after cleaning, aligning, and adjustment, and the zero value 24 hours later just prior to cleaning, aligning, and adjustment. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the 95 percent confidence interval.

9.2.6 Calibration Drift. Using the span value measured every 24 hours during the field test, calculate the differences between the span value after cleaning, aligning, and adjustment of zero and span, and the span value 24 hours later just after cleaning, aligning, and adjustment of zero and before adjustment of span. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the confidence interval.

9.2.7 Response Time. Using the data from paragraph 8.1, calculate the time interval from filter insertion to 95 percent of the final stable value for all upscale and downscale traverses. Report the mean of the 10 upscale and downscale test times.

9.2.8 Operational Test Period. During the 168-hour operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system is operated within the specified performance parameters and does not require corrective maintenance, repair, replacement, or adjustment other than as specified above during the 168-hour test period, the operational test period shall have been successfully concluded. Failure of the continuous monitoring system to meet these requirements shall call for a repetition of the 168-hour test period. Portions of the tests which were satisfactorily completed need not be repeated. Failure to meet any performance specification(s) shall call for a repetition of the one-week operational test period and that specific portion of the tests required by paragraph 8 related to demonstrating compliance with the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

10. References.

10.1 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

10.2 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Calibrated Neutral Density Filter Data
(See paragraph 8.1.1)

Low Range ____ % opacity Span Value ____ % opacity	Mid Range ____ % opacity	High Range ____ % opacity
Date of Test _____ Location of Test _____		
Calibrated Filter ¹	Analyzer Reading % Opacity	Differences ² % Opacity
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
Mean difference	Low _____ Mid _____ High _____	
Confidence interval	_____	
Calibration error = Mean Difference ³ + C.I.	_____	
¹ Low, mid or high range ² Calibration filter opacity - analyzer reading ³ Absolute value		

Figure 1-1. Calibration Error Test

Date of Test _____	Location of Test _____
Span Filter _____	% Opacity _____
Analyzer Span Setting _____	% Opacity _____
Upscale	1 _____ seconds
	2 _____ seconds
	3 _____ seconds
	4 _____ seconds
	5 _____ seconds
Downscale	1 _____ seconds
	2 _____ seconds
	3 _____ seconds
	4 _____ seconds
	5 _____ seconds
Average response	_____ seconds

Figure 1-2. Response Time Test

mitted to demonstrate that the emissions sampled or viewed are consistently representative for several typical facility process operating conditions.

4.3 The owner or operator may perform a traverse to characterize any stratification of effluent gases that might exist in a stack or duct. If no stratification is present, sampling procedures under paragraph 4.1 may be applied even though the eight diameter criteria is not met.

4.4 When single point sampling probes for extractive systems are installed within the

stack or duct under paragraphs 4.1 and 4.2.1, the sample may not be extracted at any point less than 1.0 meter from the stack or duct wall. Multipoint sampling probes installed under paragraph 4.2.2 may be located at any points necessary to obtain consistently representative samples.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 2-1 to be considered acceptable under this method.

TABLE 2-1.—Performance specifications

Parameter	Specification
1. Accuracy ¹	≤20 pct of the mean value of the reference method test data.
2. Calibration error ¹	≤5 pct of each (50 pct, 90 pct) calibration gas mixture value.
3. Zero drift (2 h) ¹	2 pct of span
4. Zero drift (24 h) ¹	Do.
5. Calibration drift (2 h) ¹	Do.
6. Calibration drift (24 h) ¹	2.5 pct of span
7. Response time	15 min maximum.
8. Operational period	168 h minimum.

¹ Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 5. For NO_x analyzers that oxidize nitric oxide (NO) to nitrogen dioxide (NO₂), the response time test under paragraph 6.3 of this method shall be performed using nitric oxide (NO) span gas. Other tests for NO_x continuous monitoring systems under paragraphs 6.1 and 6.2 and all tests for sulfur dioxide systems shall be performed using the pollutant span gas specified by each subpart.

6.1 Calibration Error Test Procedure. Set up and calibrate the complete continuous monitoring system according to the manufacturer's written instructions. This may be accomplished either in the laboratory or in the field.

6.1.1 Calibration Gas Analyses. Triplicate analyses of the gas mixtures shall be performed within two weeks prior to use using Reference Methods 6 for SO₂ and 7 for NO_x. Analyze each calibration gas mixture (50%, 90%) and record the results on the example sheet shown in Figure 2-1. Each sample test result must be within 20 percent of the averaged result or the tests shall be repeated. This step may be omitted for non-extractive monitors where dynamic calibration gas mixtures are not used (6.1.2).

6.1.2 Calibration Error Test Procedure. Make a total of 15 nonconsecutive measurements by alternately using zero gas and each calibration gas mixture concentration (e.g., 0%, 50%, 0%, 90%, 50%, 90%, 0%, etc.). For nonextractive continuous monitoring systems, this test procedure may be performed by using two or more calibration gas cells whose concentrations are certified by the manufacturer to be functionally equivalent to these gas concentrations. Convert the continuous monitoring system output readings to ppm and record the results on the example sheet shown in Figure 2-2.

6.2 Field Test for Accuracy (Relative), Zero Drift, and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of the span so that negative zero drift can be quantified. Operate the system for an initial 168-hour conditioning period in normal operating manner.

6.2.2 Operational Test Period. Operate the continuous monitoring system for an addi-

tional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.2.1 Field Test for Accuracy (Relative). For continuous monitoring systems employing extractive sampling, the probe tip for the continuous monitoring system and the probe tip for the Reference Method sampling train should be placed at adjacent locations in the duct. For NO_x continuous monitoring systems, make 27 NO_x concentration measurements, divided into nine sets, using the applicable reference method. No more than one set of tests, consisting of three individual measurements, shall be performed in any one hour. All individual measurements of each set shall be performed concurrently, or within a three-minute interval and the results averaged. For SO₂ continuous monitoring systems, make nine SO₂ concentration measurements using the applicable reference method. No more than one measurement shall be performed in any one hour. Record the reference method test data and the continuous monitoring system concentrations on the example data sheet shown in Figure 2-3.

6.2.2.2 Field Test for Zero Drift and Calibration Drift. For extractive systems, determine the values given by zero and span gas pollutant concentrations at two-hour intervals until 15 sets of data are obtained. For nonextractive measurement systems, the zero value may be determined by mechanically producing a zero condition that provides a system check of the analyzer internal mirrors and all electronic circuitry including the radiation source and detector assembly or by inserting three or more calibration gas cells and computing the zero point from the upscale measurements. If this latter technique is used, a graph(s) must be retained by the owner or operator for each measurement system that shows the relationship between the upscale measurements and the zero point. The span of the system shall be checked by using a calibration gas cell certified by the manufacturer to be functionally equivalent to 50 percent of span concentration. Record the zero and span measurements (or the computed zero drift) on the example data sheet shown in Figure 2-4. The two-hour periods over which measurements are conducted need not be consecutive but may not overlap. All measurements required under this paragraph may be conducted concurrent with tests under paragraph 6.2.2.1.

6.2.2.3 Adjustments. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention or initiation are allowable at any time. During the entire 168-hour operational test period, record on the example sheet shown in Figure 2-5 the values given by zero and span gas pollutant concentrations before and after adjustment at 24-hour intervals.

6.3 Field Test for Response Time.

6.3.1 Scope of Test. Use the entire continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one pollutant source (stack), repeat this test for each sampling point.

6.3.2 Response Time Test Procedure. Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of pollutant gas. Record the time from concentration switching to 95 percent of final stable response. For non-extractive monitors, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. Record the results of each test on the example sheet shown in Figure 2-6.

7. Calculations, Data Analysis and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 2-1.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad \text{Equation 2-1}$$

where:

x_i = absolute value of the measurements,
 Σ = sum of the individual values,
 \bar{x} = mean value, and
 n = number of data points.

7.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 2-2:

$$C.I._{95} = \frac{t_{.975}}{n\sqrt{n-1}} \sqrt{n(\Sigma x_i^2) - (\Sigma x_i)^2} \quad \text{Equation 2-2}$$

where:

Σx_i = sum of all data points,
 $t_{.975} = t_{1-\alpha/2}$, and
 $C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.

Values for $t_{.975}$

	$t_{.975}$
1	12.706
2	4.303
3	3.182
4	2.776
5	2.571
6	2.447
7	2.365
8	2.306
9	2.262
10	2.228
12	2.201
15	2.179
20	2.160
25	2.145
30	2.131

The values in this table are already corrected for $n-1$ degrees of freedom. Use n

equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Accuracy (Relative). For each of the nine reference method test points, determine the average pollutant concentration reported by the continuous monitoring system. These average concentrations shall be determined from the continuous monitoring system data recorded under 7.2.2 by integrating or averaging the pollutant concentrations over each of the time intervals concurrent with each reference method testing period. Before proceeding to the next step, determine the basis (wet or dry) of the continuous monitoring system data and reference method test data concentrations. If the bases are not consistent, apply a moisture correction to either reference method concentrations or the continuous monitoring system concentrations as appropriate. Determine the correction factor by moisture tests concurrent with the reference method testing periods. Report the moisture test method and the correction procedure employed. For each of the nine test runs determine the difference for each test run by subtracting the respective reference method test concentrations (use average of each set of three measurements for NO_x) from the continuous monitoring system integrated or averaged concentrations. Using these data, compute the mean difference and the 95 percent confidence interval of the differences (equations 2-1 and 2-2). Accuracy is reported as the sum of the absolute value of the mean difference and the 95 percent confidence interval of the differences expressed as a percentage of the mean reference method value. Use the example sheet shown in Figure 2-3.

7.2.2 Calibration Error. Using the data from paragraph 6.1, subtract the measured pollutant concentration determined under paragraph 6.1.1 (Figure 2-1) from the value shown by the continuous monitoring system for each of the five readings at each concentration measured under 6.1.2 (Figure 2-2). Calculate the mean of these difference values and the 95 percent confidence intervals according to equations 2-1 and 2-2. Report the calibration error (the sum of the absolute value of the mean difference and the 95 percent confidence interval) as a percentage of each respective calibration gas concentration. Use example sheet shown in Figure 2-2.

7.2.3 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using

equations 2-1 and 2-2. Report the zero drift as the sum of the absolute mean value and the confidence interval as a percentage of span. Use example sheet shown in Figure 2-4.

7.2.4 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 2-1 and 2-2. Report the zero drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use example sheet shown in Figure 2-5.

7.2.5 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 2-1 and 2-2. Do not use the differences between non-consecutive readings. Report the calibration drift as the sum of the absolute mean and confidence interval as a percentage of span. Use the example sheet shown in Figure 2-4.

7.2.6 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment, and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 2-1 and 2-2. Report the calibration drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use the example sheet shown in Figure 2-5.

7.2.7 Response Time. Using the charts from paragraph 6.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Use the example sheet shown in Figure 2-6.

7.2.8 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than

that clearly specified as required in the operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168-hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

8. References.

8.1 "Monitoring Instrumentation for the Measurement of Sulfur Dioxide in Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., February 1973.

8.2 "Instrumentation for the Determination of Nitrogen Oxides Content of Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., Volume 1, APTD-0847, October 1971; Volume 2, APTD-0942, January 1972.

8.3 "Experimental Statistics," Department of Commerce, Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

8.4 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Date _____	Reference Method Used _____
Mid-Range Calibration Gas Mixture	
Sample 1 _____ ppm	
Sample 2 _____ ppm	
Sample 3 _____ ppm	
Average _____ ppm	
High-Range (span) Calibration Gas Mixture	
Sample 1 _____ ppm	
Sample 2 _____ ppm	
Sample 3 _____ ppm	
Average _____ ppm	

Figure 2-1. Analysis of Calibration Gas Mixtures

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Calibration Gas Mixture Data (From Figure 2-1)			
Mid (50%) _____ ppm		High (90%) _____ ppm	
Run #	Calibration Gas Concentration, ppm	Measurement System Reading, ppm	Differences, ¹ ppm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
		Mid	High
Mean difference		_____	_____
Confidence interval		+ _____	+ _____
Calibration error =		$\frac{\text{Mean Difference}^2 + \text{C.I.}}{\text{Average Calibration Gas Concentration}} \times 100$	
		_____ %	_____ %

¹ Calibration gas concentration - measurement system reading

² Absolute value

Figure 2-2. Calibration Error Determination

Test No.	Date and Time	Reference Method Samples					Analyzer 1-Hour Average (ppm)*	Difference (ppm)
		SO ₂ Sample 1 (ppm)	NO Sample 1 (ppm)	NO Sample 2 (ppm)	NO Sample 3 (ppm)	NO Sample Average (ppm)		
1								
2								
3								
4								
5								
6								
7								
8								
9								

Mean reference method test value (SO₂) _____ Mean reference method test value (NO_x) _____ Average of the differences _____

Mean differences** = _____ ppm (SO₂), = _____ ppm (NO_x).

95% Confidence Intervals = ± _____ ppm (SO₂), = ± _____ ppm (NO_x).

Accuracies = $\frac{\text{Mean difference (absolute value)} + 95\% \text{ confidence interval}}{\text{Mean reference method value}} \times 100 =$ _____ % (SO₂), = _____ % (NO_x).

* Explain and report method used to determine integrated averages.

** Mean differences = the average of the differences minus the mean reference method test value.

Figure 2-3. Accuracy Determination (SO₂ and NO_x)

Date of Test	_____
Span Gas Concentration	_____ ppm
Analyzer Span Setting	_____ ppm
Upscale	1 _____ seconds
	2 _____ seconds
	3 _____ seconds
Average upscale response	_____ seconds
Downscale	1 _____ seconds
	2 _____ seconds
	3 _____ seconds
Average downscale response	_____ seconds
System average response time (slower time) =	_____ seconds.
Deviation from slower system average response	$= \left[\frac{\text{average upscale minus average downscale}}{\text{slower time}} \right] \times 100\% = \underline{\hspace{2cm}}$

Figure 2-6. Response Time

Performance Specification 3—Performance specifications and specification test procedures for monitors of CO₂ and O₂ from stationary sources.

1. Principle and Applicability.

1.1 Principle. Effluent gases are continuously sampled and are analyzed for carbon dioxide or oxygen by a continuous monitoring system. Tests of the system are performed during a minimum operating period to determine zero drift, calibration drift, and response time characteristics.

1.2 Applicability. This performance specification is applicable to evaluation of continuous monitoring systems for measurement of carbon dioxide or oxygen. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator. Sampling may include either extractive or non-extractive (in-situ) procedures.

2. Apparatus.

2.1 Continuous Monitoring System for Carbon Dioxide or Oxygen.

2.2 Calibration Gas Mixtures. Mixture of known concentrations of carbon dioxide or oxygen in nitrogen or air. Midrange and 90 percent of span carbon dioxide or oxygen concentrations are required. The 90 percent of span gas mixture is to be used to set and check the analyzer span and is referred to as span gas. For oxygen analyzers, if the span is higher than 21 percent O₂, ambient air may be used in place of the 90 percent of span calibration gas mixture. Triplicate analyses of the gas mixture (except ambient air) shall be performed within two weeks prior to use using Reference Method 3 of this part.

2.3 Zero Gas. A gas containing less than 100 ppm of carbon dioxide or oxygen.

2.4 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of carbon dioxide or oxygen in a given

source effluent. The system consists of three major subsystems:

3.1.1 Sampling Interface. That portion of the continuous monitoring system that performs one or more of the following operations: delineation, acquisition, transportation, and conditioning of a sample of the source effluent or protection of the analyzer from the hostile aspects of the sample or source environment.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder. That portion of the continuous monitoring system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of oxygen or carbon dioxide concentration at which the continuous monitoring system is set that produces the maximum data display output. For the purposes of this method, the span shall be set no less than 1.5 to 2.5 times the normal carbon dioxide or normal oxygen concentration in the stack gas of the affected facility.

3.3 Midrange. The value of oxygen or carbon dioxide concentration that is representative of the normal conditions in the stack gas of the affected facility at typical operating rates.

3.4 Zero Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the carbon dioxide or oxygen concentration at the time for the measurements is zero.

3.5 Calibration Drift. The change in the continuous monitoring system output over a stated time period of normal continuous operation when the carbon dioxide or oxygen continuous monitoring system is measuring the concentration of span gas.

3.6 Operational Test Period. A minimum period of time over which the continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.7 Response time. The time interval from a step change in concentration at the input to the continuous monitoring system to the time at which 95 percent of the correspond-

ing final value is displayed on the continuous monitoring system data recorder.

4. Installation Specification.

Oxygen or carbon dioxide continuous monitoring systems shall be installed at a location where measurements are directly representative of the total effluent from the affected facility or representative of the same effluent sampled by a SO₂ or NO_x continuous monitoring system. This requirement shall be complied with by use of applicable requirements in Performance Specification 2 of this appendix as follows:

4.1 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Not Used to Convert Pollutant Data. A sampling location shall be selected in accordance with the procedures under paragraphs 4.2.1 or 4.2.2, or Performance Specification 2 of this appendix.

4.2 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Used to Convert Pollutant Continuous Monitoring System Data to Units of Applicable Standards. The diluent continuous monitoring system (oxygen or carbon dioxide) shall be installed at a sampling location where measurements that can be made are representative of the effluent gases sampled by the pollutant continuous monitoring system(s). Conformance with this requirement may be accomplished in any of the following ways:

4.2.1 The sampling location for the diluent system shall be near the sampling location for the pollutant continuous monitoring system such that the same approximate point(s) (extractive systems) or path (in-situ systems) in the cross section is sampled or viewed.

4.2.2 The diluent and pollutant continuous monitoring systems may be installed at different locations if the effluent gases at both sampling locations are nonstratified as determined under paragraphs 4.1 or 4.3, Performance Specification 2 of this appendix and there is no in-leakage occurring between the two sampling locations. If the effluent gases are stratified at either location, the procedures under paragraph 4.2.2, Performance Specification 2 of this appendix shall be used for installing continuous monitoring systems at that location.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 3-1 to be considered acceptable under this method.

6. Performance Specification Test Procedures.

The following test procedures shall be used to determine conformance with the requirements of paragraph 4. Due to the wide variation existing in analyzer designs and principles of operation, these procedures are not applicable to all analyzers. Where this occurs, alternative procedures, subject to the approval of the Administrator, may be employed. Any such alternative procedures must fulfill the same purposes (verify response, drift, and accuracy) as the following procedures, and must clearly demonstrate conformance with specifications in Table 3-1.

6.1 Calibration Check. Establish a calibration curve for the continuous monitoring system using zero, midrange, and span concentration gas mixtures. Verify that the resultant curve of analyzer reading compared with the calibration gas value is consistent with the expected response curve as described by the analyzer manufacturer. If the expected response curve is not produced, additional calibration gas measurements shall be made, or additional steps undertaken to verify

the accuracy of the response curve of the analyzer.

6.2 Field Test for Zero Drift and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

TABLE 3-1.—Performance specifications

Parameter	Specification
1. Zero drift (2 h) ¹	≤0.4 pct O ₂ or CO ₂
2. Zero drift (24 h) ¹	≤0.5 pct O ₂ or CO ₂
3. Calibration drift (2 h) ¹	≤0.4 pct O ₂ or CO ₂
4. Calibration drift (24 h) ¹	≤0.5 pct O ₂ or CO ₂
5. Operational period.....	168 h minimum
6. Response time.....	10 min.

¹ Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of span so that negative zero drift may be quantified. Operate the continuous monitoring system for an initial 168-hour conditioning period in a normal operational manner.

6.2.2 Operational Test Period. Operate the continuous monitoring system for an additional 168-hour period maintaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.3 Field Test for Zero Drift and Calibration Drift. Determine the values given by zero and midrange gas concentrations at two-hour intervals until 15 sets of data are obtained. For non-extractive continuous monitoring systems, determine the zero value given by a mechanically produced zero condition or by computing the zero value from upscale measurements using calibrated gas cells certified by the manufacturer. The midrange checks shall be performed by using certified calibration gas cells functionally equivalent to less than 50 percent of span. Record these readings on the example sheet shown in Figure 3-1. These two-hour periods need not be consecutive but may not overlap. In-situ CO₂ or O₂ analyzers which cannot be fitted with a calibration gas cell may be calibrated by alternative procedures acceptable to the Administrator. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the continuous monitoring system without operator intervention or initiation are allowable at any time. During the entire 168-hour test period, record the values given by zero and span gas concentrations before and after adjustment at 24-hour intervals in the example sheet shown in Figure 3-2.

6.3 Field Test for Response Time.

6.3.1 Scope of Test.

This test shall be accomplished using the continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one source (stack), this test shall be repeated for each sampling point.

6.3.2 Response Time Test Procedure.

Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized,

switch quickly to a known concentration of gas at 90 percent of span. Record the time from concentration switching to 95 percent of final stable response. After the system response has stabilized at the upper level, switch quickly to a zero gas. Record the time from concentration switching to 95 percent of final stable response. Alternatively, for nonextractive continuous monitoring systems, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. For each test, record the results on the data sheet shown in Figure 3-3.

7. Calculations, Data Analysis, and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 3-1.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad \text{Equation 3-1}$$

where:

x_i = absolute value of the measurements,
 Σ = sum of the individual values,
 \bar{x} = mean value, and
 n = number of data points.

7.2.1 The 95 percent confidence interval (two-sided) is calculated according to equation 3-2:

$$C.I._{95} = \frac{t_{.975}}{n\sqrt{n-1}} \sqrt{n(\Sigma x_i^2) - (\Sigma x_i)^2} \quad \text{Equation 3-2}$$

where:

ΣX = sum of all data points,
 $t_{.975} = t_{\alpha/2}$, and
 $C.I._{95}$ = 95 percent confidence interval estimated of the average mean value.

Values for $t_{.975}$

n	$t_{.975}$
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.228
11	2.201
12	2.179
13	2.160
14	2.145
15	2.131

The values in this table are already corrected for $n-1$ degrees of freedom. Use n equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between the consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean value and the confidence interval on the data sheet shown in Figure 3-1.

7.2.2 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 3-1 and 3-2.

Record the zero drift (the sum of the absolute mean and confidence interval) on the data sheet shown in Figure 3-2.

7.2.3 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 3-1 and 3-2. Do not use the differences between non-consecutive readings. Record the sum of the absolute mean and confidence interval upon the data sheet shown in Figure 3-1.

7.2.4 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean and confidence interval on the data sheet shown in Figure 3-2.

7.2.5 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not receive any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's written operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168 hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

7.2.6 Response Time. Using the data developed under paragraph 5.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Record the results on Figure 3-3.

8. References.

8.1 "Performance Specifications for Stationary Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

8.2 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, by sec. 15(c) (2) of Pub. L. 91-604, 85 Stat. 1713 (42 U.S.C. 1857g)).

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Data Set No.	Time Begin	Time End	Date	Zero Reading	Zero Drift (ΔZero)	Span Reading	Span Drift (ΔSpan)	Calibration Drift (ΔSpan-ΔZero)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Zero Drift = [Mean Zero Drift] + CI (Zero) _____
 Calibration Drift = [Mean Span Drift] + CI (Span) _____
 *Absolute Value.

Figure 3-1. Zero and Calibration Drift (2 Hour).

[illegible]

Date of Test _____	
Span Gas Concentration _____ ppm	
Analyzer Span Setting _____ ppm	
Upscale	1. _____ seconds
	2. _____ seconds
	3. _____ seconds
Average upscale response _____ seconds	
Downscale	1. _____ seconds
	2. _____ seconds
	3. _____ seconds
Average downscale response _____ seconds	
System average response time (slower time) = _____ seconds	
$\% \text{ deviation from slower} = \frac{\text{average upscale minus average downscale}}{\text{system average response}} \times 100\%$	
$= \underline{\hspace{2cm}}$	
Figure 3-3. Response	

[FR Doc.75-26565 Filed 10-3-75;8:45 am]